Initiation of End-User Specific Grain Marketing at Iowa Elevators

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Abstract
The newest concept in grain marketing is to identify specific quality needs of individual users, resulting in more efficient allocation of grain supplies, greater user satisfaction, and increased value of U.S. grain. This paper presents results from a project that assimilated and organized information about the market potential of end-user specific (value-added) grains. The author suggests that the country elevator will become the key point for segregation of grains by quality.

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INITIATION OF END-USER SPECIFIC GRAIN MARKETING AT IOWA ELEVATORS

Executive Summary

This report contains results from a project that assimilated and organized information about the market potential of end-user specific (value-added) grains. VA grains are grains which, by virtue of some measurable property, have higher value for specific uses than ordinary, undifferentiated grain.

There is a wide variety of corn and soybean properties that have value to end users. The various end users will not have the same quality preferences. Based on the economics of major end uses, corn and soybeans have enough naturally occurring variations to justify 10 to 30 cents-per-bushel value differentials. This is less than the expected costs of specialty production and identity preservation, which means that most quality-segregated grains will be handled as bulk grains in the current system. Grains that are, by genetic design, of much higher value (more than 50 cents per bushel) will justify the added costs of non-traditional handling methods.

The economic value of principal quality corn and soybean factors can be quantitatively estimated for pricing purposes. Most of these factors are compositional (protein, oil, starch, fiber, texture). The maximum variation in quality occurs at the farm level, before lots are commingled in handling. This means that the country elevator, as the first point of sale, will be the key point for segregation of grains by quality.

In actual on-site case studies, country elevators were able to operate electronic near-infrared analyzers that measure composition, within the constraints of their grain receiving rates and personnel. The testing and segregation of bulk grain by composition will cost 2 to 4 cents per bushel, which is less than half of the potential value increase created by the segregation. Country elevator costs should not be an impediment to marketing grain by end-use properties.

Country elevator operators are not accustomed to testing inbound grains for intrinsic quality factors. However, there is a recognition that end-use specific marketing is a strong trend for the future. A proposal soliciting economic development funds for instrument purchase and installation was developed.

Fifteen elevators agreed to purchase near-infrared analyzers. The Iowa Department of Economic Development was asked to provide approximately 40 percent of the purchase and calibration costs for these instruments. This request was approved May 23, 1995. This would be the first such network for corn and soybean marketing in the United States. Analyzers were to operate during harvest of 1995. The total project cost was about $500,000.

VA grain marketing is becoming a market reality. The major current needs relate to training producers and elevator operators, and to the interpretation of the data that analysis technologies can provide.

CUSTOMER DEMANDS FOR QUALITY GRAIN:
THE MARKET OF THE **19905**

The newest concept in grain marketing is to identify specific quality needs of individual users. Grain supplies are allocated more efficiently, users are more satisfied, and the value of U.S. grain increases. By most estimates, the value of U.S. corn and soybeans could be increased by 10 to 30 cents per bushel if quality were more closely matched to user needs. Capture of these benefits requires major changes in grain marketing operations..

Quality has also been a negative factor for U.S. competitiveness in world markets. Grain of equal or higher quality can be bought for lower prices from non-U.S. suppliers. Quality is a very real component of price. Psychological reactions to appearance, sanitation, and similar attributes are probably increasing the impact of quality beyond what pure economic calculations would predict.

What Is Quality?

Quality means different things to different buyers. There are three general classifications of grain quality factors.

Table 1. Classification of grain quality factors

1. Defects.
    - Foreign material
    - Damage
    - Heat damage
    - Toxic substances

    Defects reduce the value of grain for all end users.

2. Shipment and storage factors.
    - Moisture variation
    - Insect infestation
    - Sour, heating

    Unstable grain quickly becomes high in defects.

3. End user related factors.
    - Composition-protein, oil, starch, etc.
    - Millability, baking quality
    - Hardness

    Different users will have different needs.

The current U.S. Grades cover defects and storage factors. The Grades (see Appendix) were created 70 years ago to serve the grain-handling industry and were based on the best available technology. The market operates within the Grades, taking profit opportunities from blending when possible. The recent expansion of competitive suppliers, often providing grain with fewer defects than that of U.S. suppliers, has caused a major rethinking of the U.S. Grades and Standards.

In 1986, Congress amended the United States Grades and Standards Act to establish objectives for Grades and Standards.

Table 2. Objectives of the U.S. Grades and Standards

1. Provide uniform descriptive terminology for trade.
2. Provide information on future storability.
3. Allow end users to determine product yields and quality.
4. Be a framework for incentives to improve quality as well as for penalties for poor quality.

These purposes signaled a major change in philosophy for the grain market. To achieve them, current standards for defect factors need to be tightened, and intrinsic factors (such as composition and hardness) will be added either to standards or market practice.

End-use Value

End-use value is the total revenue of end products produced from a unit of raw grain. **Quality** factors relating to end-use value are often intrinsic properties not alterable once the grain is harvested. Marketing grain by end-use value involves several important concepts.

Table 3. End-use value grain marketing concepts

1. Users will not have identical preferences.
2. Sellers must know user economics.
3. Sellers must be willing to merchandise grain by end-use value.
4. Grain is a product, not a commodity.
5. Advances in technology will make end-use value marketing possible.
6. End-use properties are intrinsic. They will have to be bought from the grower.

The farmer and the country elevator will have to be much more involved in quality incentives than they currently are. Identification of intrinsic properties must be done at the first point-of-sale. Therefore, producer and elevator operations must adapt.

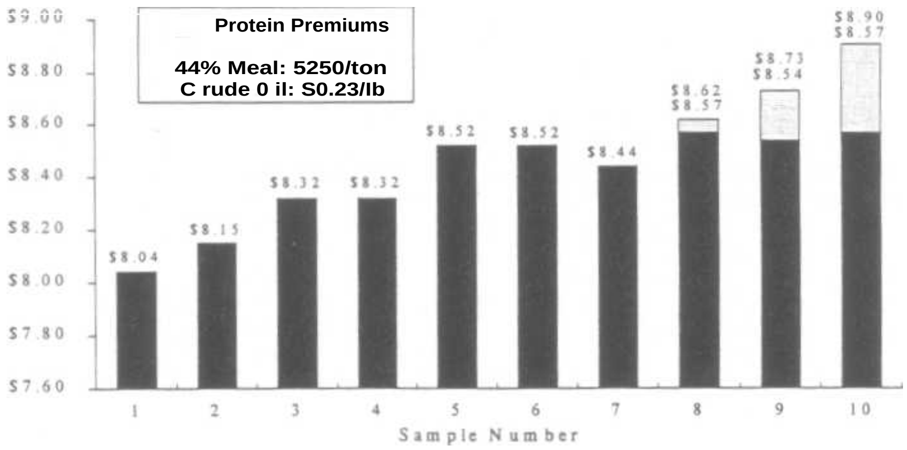
End-user Economics

Quality factors must reflect real economic value differences. Table 4 gives the major corn and soybean end uses, and the quality factors most important to them.

The existence of a formula to calculate economic value is crucial to market usage of intrinsic factors. Quality gains are balanced against any increased procurement costs. The farmer considers yield versus quality, another economic decision.

Estimated processed value is an index developed at Iowa State University for measuring the utilization value of grain. Estimated processed value per bushel (EPVB) is the total value of products originating from a bushel of grain. Soybean processors sell three products: soybean oil, soybean meal, and millfeed. Corn wet mills sell starch (or ethanol or sweeteners), gluten feed, corn oil, and several other lower volume products. Livestock feeders sell pounds of meat.

Figure 1 shows an example of EPVB differences among typical soybean samples, based on their protein and oil content. Sample 1 is low in protein and high in oil; sample 10 is relatively higher



	1	2	3	4	5	6	7	8	9	10
Protein (% @ 13% MC)	31.6	33.1	33.9	34.6	34.8	35.5	35.5	36.6	38.0	38.4
Oil (% @ 13% MC)	20.1	18.9	19.0	18.1	19.1	18.2	17.7	17.5	16.6	17.4

Figure 1. Estimated processed value per bushel (EPVB) of 10 typical soybean samples

Table 4. Corn and soybean end uses, with estimated intrinsic quality requirements

Grain	End use	Important quality factors: Large volume use	Important quality factors: Specialty, lower volume use (< 1 % of market)
Corn	Animal feed	'Crude Protein (high) 'Oil (high) 'Fiber (low) 'Lysine (swine) 'Methionine (poultry)	Other amino acids
	Wet milling (ethanol, sweeteners, oil, gluten feed)	'Protein (low) 'Oil (high) 'Starch (high) 'Density-hardness (moderate, soft)	Starch properties
	Dry milling (grits, flakes)	'Density-hardness (high, hard) 'Protein (high) 'Oil (low)	Extra-large kernels
	Alkaline cooking (Mexican foods, snack chips)	Density-hardness (medium-high, medium) Protein (high) Density (high) Cob color (light)	
	"Average" corn	8.0% protein, 3.6% oil, 60% starch, 1.250-1.260 gm/cm' density, 0.25% lysine, 0.19 % methionine (basis 15 % moisture)	
Soybeans	Crush (meal, oil)	'Protein & oil (high) 'Fiber (low)	'Fatty acid composition 'Amino acid composition
	Food (tofu, other soy foods)		Protein (high) Oil (low) Seed size (large) Defects (low) Hilum color (clear)
	"Average" soybeans	35% protein, 19.0% oil, 4.5% fiber, 2400-2500 seeds/lb.	

'Economic value of factors can be estimated from available formulas.

in protein and lower in oil. Under this market scenario for meal and oil, the processor would experience almost a dollar per bushel difference in total revenue from products. The gray "protein premiums" boxes represent the need for meal users (feeders) to recognize protein levels over the basic 44 percent specification. The figures were determined from the Iowa State University soybean processing model, SPROC.

The concept of *estimated processed value* applies equally to corn. Table 5 relates corn protein content to value, for two assumptions of soybean meal price. The difference between 8 percent, an average protein, and 10 percent, a high protein, is about 20 to 30 cents per bushel.

Table 5. The value of corn protein content in livestock feed

Corn Protein Content	Soybean Meal Price	
	$225/ton	$325/ton
Percent	Corn Value $/bushel	
6	2.29	2.13
8 (Average)	2.50	*2.50*
10	*2.71*	*2.86*

Another important corn characteristic is hardness, the proportion of dark yellow to soft white starch. Hardness is most important to the dry-milling and alkaline cooking industries that flake and/or soak the corn to make breakfast cereals, snack foods, etc. Harder corn produces larger grits and better flakes. A hard corn will have a 40 to 50 cents per bushel advantage compared to a soft corn in dry milling.

Types of Quality Segregation

Intrinsic quality can be identified for both large-volume bulk users and low-volume niche product consumers. The large-volume segregation probably will not generate more than 10 to 30 cents of value-added per bushel, to be apportioned among users, handlers, and growers. In this case, the grain will probably be tested at delivery against some specification, with no attempt beyond price adjustment to control production. For small value-added (less than 10 cents per bushel) the handlers may even try to sort existing grain, with no incentive offered. This is the situation in wheat protein, where the miller premiums are so inconsistent that paying premiums to growers is too risky.

Niche products (e.g. food soybeans, waxy corn) generate upwards of 50 cents per bushel value-added. These are, and will be, grown under identity preservation contracts. Contracting for high volume, low value-added grains probably will not be feasible. High value grains will be kept under stricter quality control from farm to end user.

Technical Issues

New Testing Equipment

End-use grain quality factors are intrinsic properties that the grain handler cannot manipulate. They are either there or not when the farmer harvests the grain. They are characteristics determined by genetics, cultural practices, and environment-factors over which the handler has little control. As a result, end-use value must be bought from the farmer. Only the farmer can make soybeans higher in protein or higher in oil, or corn harder. This is quite different from the characteristics now in the U.S. Grades and Standards. There will be a greater burden on country elevators where, at the moment, the least testing is done.

Table 6 gives some criteria for successful grain quality tests for a country elevator. Speed is probably the major concern, particularly at harvest. There is not much time to do these tests, nor staff available to do them. For efficiency purposes, the instrumentation industry must develop instruments that measure more than one factor simultaneously. An example is the whole-grain near-infrared transmission test for composition that is also better at measuring moisture than the current electrical capacitance moisture meters.

Table 6. Criteria for grain quality tests at country elevators

1. Complete test in one minute or less.
2. Instrument measures more than one quality factor.
3. Procedure to standardize accuracy against a national reference.
4. Clear economic formula to set premiums and discounts.

The end-use value grain quality tests require more sophisticated equipment than current grading factors. There will have to be some form of national standardization for country elevator tests either with the USDA, Federal Grain Inspection Service, or with an industry-accepted private entity.

Selective Storage and Handling

The country elevator will have to physically manage quality-differentiated grains. Traffic flow is going to be a major concern. Although country elevators are very different from one another, all elevators will have peak traffic at harvest. The peak receiving rate is the critical item for designing operating practices. In the Corn Belt, most elevators receive 50 to 75 percent of their total harvest receipts (of either corn or soybeans) in a one-week period sometime in October or November.

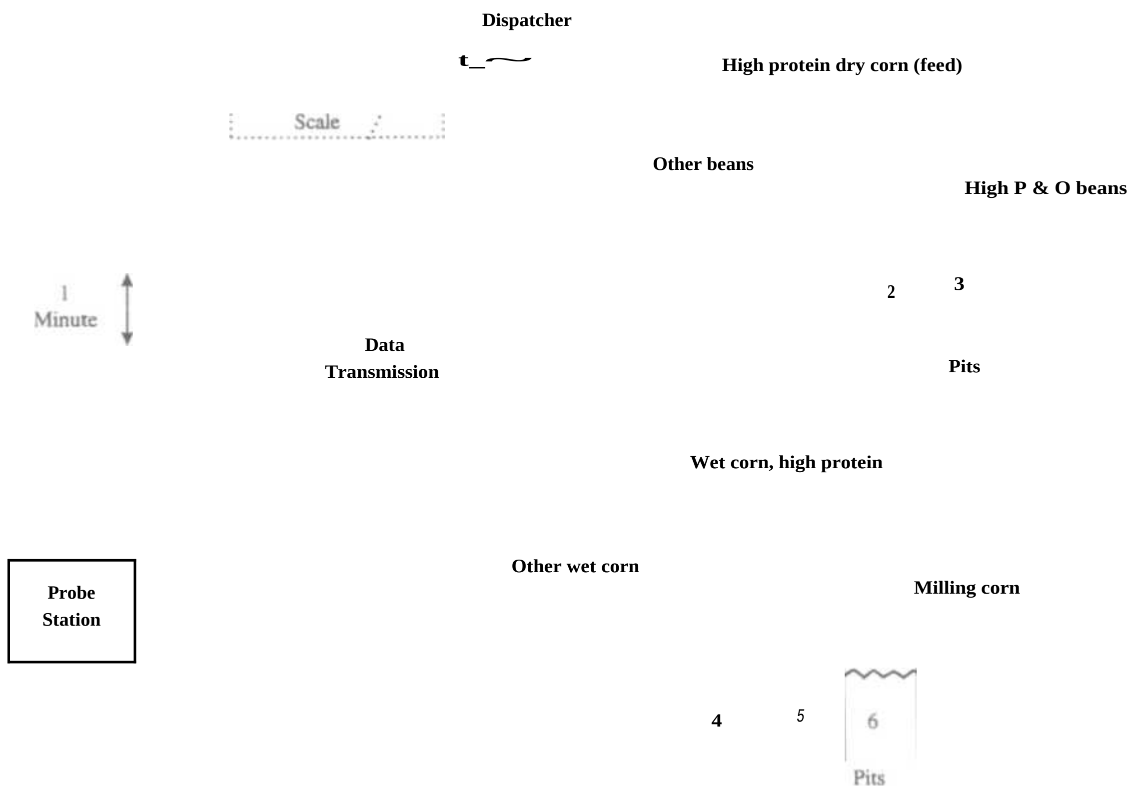


Figure 2. Example of traffic flow patterns for separation of corn and soybeans by end-use value

There could be any number of separations, depending on how the grain is merchandised. But, remember that the same volume will still be handled with storages consigned differently than before. Consigning the storages correctly to have them full will certainly be a major concern. This will require forecasting and statistical knowledge. Buyers *and local grain elevators will have to work together.*

Smaller elevators may have fewer segregations, selected to fit the major local market(s). Others may elect to segregate only in the non-harvest season. The greatest challenge will be operating skills rather than construction of new facilities.

It is widely believed that additional segregation will represent major new costs for the country elevator. Case studies and economic models show otherwise, provided the elevator operates within the flexibility limits of its facility; in other words, targets markets carefully. Table 7 summarizes a case study of segregation costs and elevator parameters for 50 elevators in three Iowa counties.

Table 7. Segregation costs and operating parameters for elevators in three Iowa counties

	Estimated Cost per Bushel			
	1.0-1.9 cents	2.0-2.9 cents	3.0-3.9 cents	4.0 cents and up
Rail elevators	3	9	4	0
Truck only elevators	2	11	14	6
Totals	5	20	18	6
Average storage (million bushel)	3.7	1.51	0.63	0.35
(range)	(0.9-6.8)	(0.8-4.0)	(0.4-1.0)	(0.1-0.5)
Percent of total capacity	28	50	19	3
Number of pits/elevator	5.2	2.9	2.1	1.4
(range)	(4-7)	(1-3)	(1-3)	(1-2)
Average elevator capacity per pit (bu/hr)	11,200	10,200	5,400	3,900
(range)	(4,500-20,000)	(5,700-15,000)	(3,000-10,000)	(3,000-5,000)

Notes: Calhoun, Webster and Marshall Counties. Costs based on testing all inbound grain, segregation of 33 percent as higher value.

Specialty Genetics

Intrinsic quality is determined to a great extent by plant genetics. Nearly every major seed company is developing corn and soybeans for specific uses. Some examples are given in Table 8.

Table 8. Examples of specific genetics

Grain	Quality trait	Uses	Benefit
Corn	'High protein (10%+)	Livestock feed	Replace more expensive protein sources
	High lysine (0.3%+)	Hog feed	Better quality protein
	High methionine (0.25%+)	Poultry feed	Better quality protein
	'High oil (8%+)	Corn wet milling	Greater yield
	'High starch (62%+)	Corn wet milling	Greater sweetener or ethanol yield
	'Hard endosperm	Corn dry milling	More large grits
	'White with yellow yields	Alkaline cooking	Efficient service to Mexican market
Soybeans	'High protein (38%+)	Processor	Greater meal and oil yields
	Low linolenic acid (3%1)	Processor	Oil with greater stability
	High stearic acid	Processor	Oil solid at room temperature

'Large volume, probably will move through bulk-handling facilities.

Specialty genetics can be developed with advanced biotechnology techniques. The ability to calculate the economic value of grain quality traits is a big incentive for seed companies to invest in specialty genetics. However, specialty grains must be moved *efficiently* to their intended end use.

Most specialty grains will move through the present bulk-handling facilities. The various forms of small-scale, identity-preserved handling are too expensive unless the grain has an additional value of 50 cents per bushel or more. In bulk-handling facilities, 5 to 10 cents per bushel is an attractive gain.

There will be competition to set up farmer-to-end user distribution networks for true specialty grains. Seed companies, with access to information about who is growing specialty grains, will probably enter this market. Most specialty grains will be patented and therefore will be unique to one company. A marketing network for the grain is necessary for the seed company to sell its product. Local grain-handling firms will have an opportunity to participate in the collection and distribution of these grains, but it is not clear who will retain the merchandising initiative-the seed company acting as a broker, or the grain handler.

Impact on Producers

Obviously any action taken by country elevators will affect producers, but producers have control over what intrinsic qualities are available. Variety selection is the primary means for altering quality, although agronomic research may reveal cultural practices that accentuate genetic capabilities. Producers will also have responsibility for isolating qualities prior to sale.

Variety Selection

Producers will have to include quality traits in selection decisions. Some grain may be produced on contract for a merchant or a user. In this case, genetic selection is prescribed. Assuming that the bulk grain market also differentiates by broad quality categories, growers will have choices in non-contract marketing.

Iowa State University has been publishing end-use property data in its corn and soybean variety trials. The reports are available at county extension offices. The ranges in Table 9 are typical of the data.

Variety or hybrid selection will involve estimating the tradeoff, if any, between quality and yield. The University trials show that there are important quality differences among current high-yielding lines. In this case, choices based on quality would not cause yield reductions. However, overt breeding efforts to improve quality (specialty genetics) usually have an associated yield loss. Perhaps biotechnology and other modern methods can lessen these tradeoffs, but the economic value of quality has to be compared with the economic loss from any reduced yield. A market premium, or an on-farm use that can capture the value of quality, is necessary for growers to make yield/quality choices. Without tangible economic rewards, the only quality improvements to be made are those that do not involve a yield penalty.

Table 9. Typical range of composition in the Iowa corn and soybean yield tests

Factor	Typical range in: (LSD' in parentheses) Corn,	Soybeans`
Protein	5.5-9.5 (0.5)	30.0-38.0 (0.9)
Oil	2.5-4.0 (0.3)	16.0-21.0 (0.5)
Starch	57.0-64.0	--

'LSD - Least significant difference between varieties (P=0.05)
,Basis 15% moisture
`Basis 13% moisture

Growing environment (geography, yearly weather patterns, farm fertility, etc.) affects intrinsic properties. For example, soybean protein is lower in the northern U.S. than in the southern U.S. Similarly, some years are "low protein" or "high protein" years, for both corn and soybeans. Hybrids or varieties which normally rank high in a quality attribute will rank high in any year, even if the average quality of all grain has shifted. Thus, the relative value among hybrids of varieties should remain stable.

Handling

Forethought will be required to handle differentiated quality grain. Production volume has to match storage capacity because qualities will have to be sorted before sale. Most likely, the intended use (and buyer or buyers) for grain will be set before planting, and storages will be preallocated to particular products.

For example, suppose a producer has three 10,000-bushel corn storage bins. Unless a buyer is going to take corn directly from the field, this producer will want about 65 acres of any special corn (@150 bu/acre) to fill one bin. Not all producers will produce all qualities. Advance planning and market research will be needed.

Summary

The market will change to meet the needs of customers. Quality is an important competitive issue-one that the U.S. cannot afford to ignore. Quality cannot be provided at the expense of quantity. Matching quality to use needs will require new effort at the producer-country elevator level, but can increase the end-user value of grain by 10 to 30 cents per bushel. While the market will determine how benefits will be distributed, local grain elevators and producers are in the best position to gain from quality differentiation.

APPENDIX

THE U.S. CORN AND SOYBEAN STANDARDS

Table A.1. The U.S. Corn Grades: Grades and Grade Requirement

		Maximum limits of:		
		Damaged Kernels		
Grade	Minimum test weight per bushel (pounds)	Heat Damaged (percent)	Total (percent)	Broken corn and foreign material (percent)
U. S. No. 1	56.0	0.1	3.0	2.0
U.S. No. 2	54.0	0.2	5.0	3.0
U.S. No. 3	52.0	0.5	7.0	4.0
U.S. No. 4	49.0	1.0	10.0	5.0
U.S. No. 5	46.0	3.0	15.0	7.0

U.S. Sample grade is corn that:

(a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4, or 5; or

(b) Contains 8 or more stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more Crotalaria seeds *(Crotalaria spp.),* 2 or more castor beans *(Ricinus communis L.)* 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance, 8 or more cocklebburs *(Xanthium spp.)* or similar seeds singly or in combination, or animal filth in excess of 0.2 percent in 1,000 grams; or

(c) Has a musty sour, or commercially objectionable foreign odor; or

(d) Is heating or otherwise of distinctly low quality.

Table A.2. The U.S. Soybean Grades: Grades and Grade Requirements

		Maximum limits of:				
		Damaged Kernels				
Grade	Minimum test weight per bushel (pounds)	Heat Damaged (percent)	Total (percent)	Foreign material (percent)	Splits (percent)	Soybeans of other colors (percent)
U. S. No. 1	56.0	0.2	2.0	1.0	10.0	1.0
U.S. No. 2	54.0	0.5	3.0	2.0	20.0	2.0
U. S. No. 3'	52.0	1.0	5.0	3.0	30.0	5.0
U.S. No. 4'	49.0	3.0	8.0	5.0	40.0	10.0

U.S. Sample grade are soybeans that:

(a) Do not meet the requirements for the grades U.S. No. 1, 2, 3, 4; or

(b) Contains 8 or more stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more Crotalaria seeds (Crotalaria spp.), 2 or more castor beans *(Ricinus communis L.) 4* or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance, 10 or more rodent pellets, bird droppings, or equivalent quantity of other animal filth per 1,000 grams of soybeans; or

(c) Have a musty, sour, or commercially objectionable foreign odor (except garlic odor); or

(d) Are heating or otherwise of distinctly low quality.

'Soybeans that are purple mottled or stained are graded not higher than U.S. No. 3.

bSoybeans that are materially weathered are graded not higher than U.S. No. 4.

ADDITIONAL RESOURCES
(Contact author for further information)

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