

Appendix B

Glossary of Terms

Adulterated grain: According to the Food, Drug and Cosmetic Act, grain is deemed to be adulterated if it contains an added or naturally occurring poisonous or deleterious substance that may render it injurious to health (e.g., aflatoxin-contaminated corn).

Aeration: The passage of air over or through grain to control the adverse effects of excessive moisture, temperature, and humidity. This is usually done by moving air with fans or through ducts.

Aflatoxins: Any of several mycotoxins that are produced, especially in corn or oil seeds, by molds (e.g., *aspergillus flavus*).

Agronomy: A branch of agriculture dealing with field crop production and soil management.

Allele: One of several possible alternate forms of a given gene.

Amino acid: A group of 20 molecules that bind together to form proteins. Each type of protein is made up of a specific sequence of amino acids coded for in the DNA.

Amylase: Any of the enzymes that accelerate the hydrolysis of starch and glycogen.

Amylopectin: A component of starch characterized by its heavy molecular weight, its branched structure of glucose units, and its tendency not to gel in aqueous solutions. The starch of normal corn is made up of amylopectin and amylose.

Amylose: A component of starch characterized by its straight chains of glucose units and the tendency of its aqueous solutions to set to a stiff gel. The starch of normal corn is made up of amylopectin and amylose.

Backcross: The crossing of a first-generation hybrid with either parent.

Bin-dryers: On-farm dryers that are generally low-capacity, low-temperature systems, capable of producing excellent quality grain.

Biochemistry: A branch of chemistry that deals with the chemical compounds and processes occurring in living organisms.

Biotechnology: Techniques that use living organisms or substances to make or modify a product. See genetic engineering and recombinant DNA.

Blending: For purposes of this assessment, blending refers to the mixing of two or more grain lots to establish an overall quality that may or may not be different from any one individual lot. Blending is done for economic reasons, to achieve uniformity for improved handling, or to meet a particular quality specification.

Broken corn and foreign material (BCFM): Any material passing through a 12/64 inch sieve, plus non-corn material remaining on top.

Bromus Secalinus (cheat): Any of several grasses, especially the common chess. This weed is a major problem for winter wheat producers in the central Plains.

Callus: Unorganized tissue formed from organized plant tissue.

Carbohydrate: Any of various neutral compounds of carbon, hydrogen, and oxygen (such as sugars, starches, and cellulose) most of which are formed by green plants.

Chromosome: A thread-like structure contained in the nucleus of a cell that carries the genes that convey hereditary characteristics.

Cleaning: For purposes of this assessment, cleaning is the removal of dockage, insects, and to a degree shrunken and broken kernels from grain by means of mechanical screening and scalping devices. Cleaning practices vary from country to country. See precleaning.

Combination dryers: On-farm dryers, mainly used for corn, that combine the best characteristics of bin and non-bin systems (i.e., high quality and high capacity), but are more complicated and expensive.

Combine: A machine that harvests grain. The first combine was patented in 1836, since then self-propelled combines of either conventional or rotary design have evolved and come into use throughout the United States and in other countries.

Concurrent-flow dryers: Off-farm commercial dryers in which grain and air flow vertically. The gentle drying and cooling methods used in these dryers results in grain of superior quality. Their main disadvantage is their high initial cost.

Corn: The seed of a cereal grass and the only important cereal plant indigenous to America. Corn is used mainly for animal feed, but it is also used for oils, starches, and syrups for human consumption, and in some industrial products. It is grown extensively in the United States, the six Corn Belt States are Iowa, Illinois, Indiana, Nebraska, Minnesota, and Ohio.

Cotyledon: The seed leaf of an embryo plant that serves as nourishment for the elementary plant.

Crossflow dryers: The most prevalent type of off-farm commercial grain dryers in the United States, in which grain and air flow in a perpen-

dicular direction. This type of dryer tends to dry the grain non-uniformly, causing stress-cracking of the kernels.

Cross-pollination: The transfer of pollen from one plant to another plant.

Cultivar: An international term denoting certain cultivated plants that are clearly distinguishable from others by one or more characteristics, and that when reproduced retain those distinguishing characteristics. In the United States “variety” is considered to be synonymous with cultivar (derived from cultivated variety). See variety,

Cytoplasm: The protoplasm of a cell outside the nucleus consisting of an aqueous solution, which is the site of most of the chemical activity of the cell.

Deficiency payments: Payments to farmers based on actual planted acres, which makeup the difference between a politically acceptable target price, and the average market price or loan rate, whichever is higher.

Determination: The process whereby the corn kernel is broken apart into endosperm, germ, and pericarp.

Deoxyribonucleic acid (DNA): The nucleic acid in chromosomes that codes for genetic information. The molecule is double stranded, with an external “backbone” formed by a chain of alternating phosphate and sugar (deoxyribose) units and an internal ladder-like structure formed by nucleotide base-pairs held together by hydrogen bonds.

Dockage: The foreign material in market grain (such as stems, weeds, and dirt), which is readily removable by ordinary cleaning devices.

Drying: For purposes of this assessment, drying is the removal of moisture from grain by various methods in both commercial and on-farm dryers. Air temperature, grain velocity, and airflow rate during the drying process have a greater influence on grain quality than all the other grain handling operations combined.

Dry milling: The basic process used to mill wheat and corn, involving the cleaning, conditioning, grinding, and sifting of the grain.

Electrophoresis: A technique used to separate molecules (such as DNA fragments or proteins) from a mixture of similar molecules. By passing an electric current through a medium containing the mixture each type of molecule travels through the medium at a rate corresponding to its electric charge and size. Separation is based on differences in net electrical charge and in size or arrangement of the molecule. This technique can be used to identify grain varieties.

Elevator leg: Part of the belt-bucket system used in commercial grain facilities. It consists of an endless vertical belt with buckets spaced evenly along it. The buckets scoop up the grain at the bottom (boot) of the leg and discharge it at the top.

Endosperm: A nutritive tissue in seed plants contained in the inner bulk of the kernel that consists primarily of complex carbohydrates. It also contains protein, riboflavin, and B vitamins. In corn, the quantity of vitreous or horny endosperm relative to floury endosperm in the kernel determines the hardness of the grain.

Environment: The complex of climatic, edaphic, and biotic factors that act upon an organism or an ecological community and determine its form and survival. The environment in which it grows greatly influences the productivity and quality of grain.

Enzyme: Any of a group of catalytic proteins that are produced by living cells and that mediate and provide the chemical processes of life without themselves being destroyed or altered.

Enzyme-linked immunosorbent assay (ELISA): A test that is used to identify proteins and plant pathogens by using antibodies to identify proteins rapidly. A protein-antibody complex is incubated with an enzyme-coupled antibody that recognizes and binds to the protein. The reaction is measured spectrophotometrically to identify the presence of the specific protein that is attached to the antibodies.

European Economic Community (EC): A group of twelve European nations, consisting of Belgium, the Federal Republic of Germany (West Germany), France, Italy, Luxembourg, the Netherlands, the United Kingdom (UK), Ireland, Denmark, Greece, Spain, and Portugal that have banded together for economic and political reasons.

Federal Grain Inspection Service (FGIS): A branch of the U.S. Department of Agriculture that establishes grain standards and develops the technology to measure the factors contained in such standards. This agency also develops and publishes sampling and inspection procedures, evaluates and approves equipment, monitors inspection accuracy, and oversees mandatory export inspection of grain by FGIS or FGIS-licensed inspectors.

Feed grains: Grains, especially corn, characterized as high-energy grains due to their relatively high levels of nitrogen-free extract and low levels of crude fiber.

Flaking grits: A product of dry-milled hard corn.

Low-fat, large flaking grits are used primarily in the manufacture of breakfast food, and coarse and regular grits are used in the brewing industry.

Flour: Finely-ground meal derived from wheat. There are four major flour types, hard wheat flour, whole wheat flour, soft wheat flour, and semolina. Flour is classified according to strength. Strong flours, derived from hard wheat and used mainly for bread-baking, are high in protein and elastic gluten (these include semolina, which is made from Durum wheat and used to manufacture pasta). Weak flours, derived from soft wheat, are used for biscuits and pastries and are low in protein and gluten.

Flour stream: Flour resulting from each separate process of dry milling. Flour from each point of the process has different characteristics and baking properties. In large flour mills 30 or more separate flour streams of varying composition and purity may be collected, grouped, and merchandised.

Fumigation: For purposes of this assessment, fumigation is the destruction of pests infesting grain by professional personnel, trained in the application of fumigants, i.e., chemicals that at required temperature and pressure can exist in a gaseous state in sufficient strength and quantities to be lethal to a given pest organism. Fumigants are some of the most toxic and unique pesticides, methyl bromide and hydrogen phosphide are the fumigants most commonly used on grain.

Fungus: Any of a major group (fungi) of parasitic lower plants that lack chlorophyll. Fungi include molds, rusts, mildews, and mushrooms. *Aspergillus flavus* is a fungus that grows on corn.

Gene: The portion of a DNA molecule that is made up of an ordered sequence of nucleotide bases and constitutes the basic functional unit of heredity.

Genetic engineering: Technologies (including recombinant DNA methods) used by scientists to isolate genes from one organism, manipulate them in the laboratory, and then insert them stably in another organism. See biotechnology and recombinant DNA.

Genome: A term used to refer to all the genetic material carried by a single germ cell.

Genotype: The hereditary makeup of an individual plant or animal, which, with the environment, controls the individual's characteristics.

Genotypic variability: The range of expression for a specific trait (e.g., the protein percentage in wheat, which can range from 7 to 30 percent).

Germplasm: The living stuff of the cell nucleus that determines the hereditary properties of organ-

isms and that transmits these properties from parents to progeny. The expression is also used in a broad sense to refer to the total hereditary makeup of organisms.

Gliadin: Simple proteins obtained from alcoholic extraction of gluten from wheat or rye.

Glume: Hull or husk.

Gluten: A tenacious, elastic protein substance, found especially in wheat flour, that gives cohesiveness to dough.

Grade-determining factors: Factors selected as indicators of value and quality that help set the numerical grade of grain.

Grading: The numerical grading of grain (e.g., Number 2 Hard Red Winter wheat) according to grade-determining factors.

Grain: The seeds or fruits of various food plants, including the cereal grasses (e.g., wheat, corn, barley, oats, and rye) and other plants in commercial and statutory use (e.g., soybeans). Grain is a living organism, and as such is a perishable commodity that can be adversely affected by improper harvesting, handling, storage, and transportation.

Grain breakage: Mechanical damage to grain that results in broken grain and fine material. This is caused by the harvesting of grain that is too dry and the cumulative damage inflicted on grain during repeated handling. Grain breakage causes decreased quality, greater storage problems, and increased rates of mold and insect infestation.

Grain quality: There is no single definition of grain quality. For purposes of this assessment grain quality is defined in terms of the physical, sanitary, and intrinsic characteristics of grain. See intrinsic quality, physical quality, and sanitary quality.

Grain standards: Legislation (the Grain Standards Act) was passed in 1916 in an attempt to establish official standards for wheat, corn, and soybeans that would describe a level of quality and provide a basis for marketing grain. This Act remained intact until the passage of the Grain Quality Improvement Act in 1986, which provided new criteria as a basis for grain standards. Measuring grain quality is difficult to standardize and there is a lack of clear objectives, goals, and criteria concerning the form and function of such standards.

Grain storage: Grain is stored in three basic ways. Vertically, in upright metal bins or concrete silos; horizontally, in flat warehouses; and in on-ground piles. See vertical storage, horizontal storage, and on-ground pile storage.

Handling technologies: Technologies and equip-

ment that are used in the receiving, drying, cleaning, storage, conveying, and transportation of grain.

Hard wheat: Wheat varieties that are high in protein (especially hard spring and winter wheats and Durum wheat),

Harvesting: The process whereby grains and oil seeds are removed from a plant, gathered, and physically removed from a field.

Hexaploid: Having six times the monoploid chromosome number. Wheat is a hexaploid plant species.

Homozygous: True breeding for a specific hereditary characteristic. A plant that breeds true for a specific characteristic (such as flower color) is called homozygous for this characteristic.

Horizontal storage: Grain storage in buildings constructed of metal, wood, or concrete, which have flat floors and are filled by means of a portable incline belt or conveyors in the roof. These storage facilities are more difficult to load, unload, aerate, and fumigate than vertical storage facilities.

Hybrid: An offspring of a cross between two genetically unlike individual plants or animals. Hybrid corn varieties have produced increased yields in some parts of the United States, and progress is being made in developing techniques for the commercial production of hybrid wheat.

Incline belt: An endless belt, used to convey grain, which is supported by rollers and driven by a shaft-mounted speed reducer motor.

Insecticides: Chemicals used to destroy insect pests. The insecticides most commonly used on grain are pyrethrins, malathion, and the more recently introduced pirimphos-methyl, chlorpyrifos-methyl, and bacillus thuringiensis (BT).

Insects: Insects create numerous problems causing loss and damage in stored grain. Grain is lost when consumed by the insects, insect wastes are left behind in the grain, and insect fragments are found in finished grain products, increased heat and moisture resulting from insect metabolic processes can lead to mold growth, and the use of insecticides can leave pesticide residues in the grain.

Intrinsic quality: Characteristics critical to the end use of grain. These are nonvisual and can only be determined by analytical tests. For example, the intrinsic quality of wheat is determined by characteristics such as protein, ash, and gluten content; the intrinsic quality of corn by its starch, protein, and oil content; and the intrinsic quality of soybeans by their protein and oil content.

Isoglucose: A sweetener and sugar substitute derived from wheat starch.

Micro-organisms: Minute, microscopic, or sub-microscopic living organisms. Examples are bacteria, mycoplasma, and viruses. They are parasites that gain their sustenance from the material that they grow on, such as grain.

Millfeed: The material remaining after all the usable flour is extracted from grain. The material is used by the feed industry to make animal feed and feed supplements.

Milling: A process by which grain kernel components are separated either physically or chemically, and grain is ground into flour or meal.

Mixed-flow dryers: The most prevalent type of large, continuous-flow, off-farm dryer used in countries outside the United States. In these dryers, grain is dried by a mixture of crossflow, concurrent flow, and counterflow drying processes, which dry grain more uniformly and produce a higher quality grain. These dryers are expensive to manufacture and require extensive air-pollution equipment.

Moisture: Moisture content and uniformity is a critical factor in grain quality. If grain is too wet or too dry at harvest damage occurs. Moisture also interacts with temperature and relative humidity in grain storage centers and during shipping, when too much moisture can spur mold growth, increase insect activity, and cause other quality losses.

Mold: A superficial growth produced on damp or decaying matter. Molds draw their sustenance from the material they grow on. Mold growth on grain creates damaged kernels, deposits toxic substances in the grain, and results in a loss of dry matter. As they grow, molds produce heat and moisture, which encourages their further proliferation.

Monogastric: An animal that has one digestive cavity (for example, swine, poultry, humans).

Near-infrared reflectance spectroscopy (NIRS): A new analytical technique that can determine the structure of compounds and the composition of substances by examining them with a spectroscope that is designed to operate in the infra-red region of the spectrum. One application of this technique is the measurement of moisture and protein percentages in wheat. See spectrophotometer.

Non-bin dryers: The most popular on-farm dryers, these are generally high-capacity, high-temperature systems, that frequently overheat and over-dry the grain, causing serious deterioration in grain quality.

Non-grade-determining factors: Factors that influence the quality of grain, but which are not taken into account in the grading of grain, and which

must be reported as information whenever an official inspection is made.

Off-farm dryers: High-capacity, high-temperature, commercial grain dryers that are used away from the farm. These fall into three categories, cross-flow, concurrent-flow, and mixed-flow dryers.

On-farm dryers: **Grain dryers used by farmers to dry grain. At least 80 percent of the United States corn crop is dried on-farm. On-farm dryers fall into three categories, bin-dryers, non-bin dryers, and combination dryers.**

On-ground pile storage: Storage of grain placed in piles directly on the ground or on pads, either covered by a tarp or left uncovered. Piles can be contained by fixed or movable sloping walls or circular rings. Grain stored by this method is difficult to load, unload, aerate, and fumigate.

Pericarp: The covering of a seed that is derived from the ovary wall.

Physical quality: Grain characteristics associated with the outward appearance of the grain kernel, including kernel size, shape, color, moisture, damage, and density.

Plant breeding: The development of plants with certain desirable characteristics. Grain breeding programs generally aim to improve yield and harvestability, increase disease resistance, and satisfy apparently desirable intrinsic quality goals.

Precleaning: The removal of foreign material such as weeds, seeds, dirt, stems, and cobs from the grain before it is dried. This results in a more uniform moisture content in the dried grain and eliminates the drying of material that detracts from grain quality. Precleaning is not generally practiced by dryer operators in the United States. See cleaning.

Protein: The total nitrogenous material in plant or animal substances. Proteins occur naturally and are complex combinations of amino acids.

Recombinant DNA: Techniques involving the incorporation of DNA fragments, generated with the use of restriction enzymes, into a suitable host organism. The host is then grown in a culture to produce clones with multiple copies of the incorporated DNA fragment. This and other genetic engineering techniques hold future promise for altering the genetic makeup of plants to enhance various desirable characteristics, but they are not yet widely used. See biotechnology and genetic engineering.

Rheology: The study of the flow of materials, particularly the plastic flow of solids.

Sanitary quality: Grain characteristics associated with cleanliness. They include the presence of

foreign material that detracts from the overall value and appearance of the grain, including the presence of dust, broken grain, rodent excreta, insects, residues, fungal infection, and nonmillable matter.

Screw auger conveyor: A round tube with a continuous screw on a spiral inside. The principal means of moving grain on farms where inexpensive portable equipment is needed.

Sedimentation test: A test that measures the quality of protein content in wheat. Ground wheat is suspended in water and treated with lactic acid. The portion that settles to the bottom of a graduated cylinder within 5 minutes is the sedimentary value.

Shrink: The loss of weight in grain due to the removal of water.

Single-cross hybrid: A first generation hybrid between two selected and usually inbred lines.

Soft wheat: Varieties of wheat that contain low amounts of protein.

Sorghum: A cultivated plant derived from a genus of Old World tropical grasses, similar to Indian corn.

Soybeans: A hairy annual Asiatic legume, widely grown for its oil rich proteinaceous seeds and for forage and soil improvement. Soybeans are used mainly for oil and for high-protein meal for animal feed. The principal soybean-producing states are Illinois, Indiana, Iowa, Missouri, Mississippi, and Ohio. The United States produces 60 percent of the world supply of soybeans.

Spectrophotometer: An instrument that measures the relative intensities of light in different parts of the spectrum. See near-infrared spectroscopy.

Steepwater: Water used to soak corn during the wet milling process.

Stress-cracks: Cracks in the horny endosperm of corn caused by the rapid drying of kernels with heated air. Stress-cracking causes increased breakage during handling and reduces flaking grit yields.

Tempering: The addition of moisture to wheat and corn during the dry milling process to aid the removal of bran from the endosperm.

Tissue culture: A technique in which portions of a plant or an animal are grown on artificial culture medium in an organized state (e.g., as plantlets) or in an unorganized state (e.g., as callus).

Triticale: A hybrid between wheat and rye that has a high yield and a rich protein content.

Unit trains: A train of 50 or more railcars departing from the same point for the same destination with one bill of lading. This is an efficient way of transporting grain.

U.S. Grain Standards Act: This Act, administered by the FGIS, requires that uniform standards be developed and used when marketing grain. Testing is provided for, but no requirement exists as to what tests should be performed on grain moving domestically within the United States. Mandatory testing of grain for export is required.

Variety: Any of various groups of plants of less than specific rank. See cultivar.

Vertical Storage: The storage of grain in upright concrete silos or metal bins that can range in size from as little as 3,000 bushel farm bins to 500,000 bushel commercial bins. They are easy to load, unload, aerate, and fumigate.

Vital wheat gluten: A wheat product containing 75 to 80 percent protein, used as a flour fortifier, the product of new advances in wheat processing technologies.

Wet milling: Processes using water in which corn is tempered and steeped and converted into starches. More than half of these starches are converted into corn syrups and corn sugars. Corn oil is also extracted during starch recovery.

Wheat: Any of various grasses high in gluten that are cultivated in various temperate areas for the grain that they yield, which is used in a vast array of products. In the United States the main wheat-producing states are Kansas, Oklahoma, Texas, Nebraska, and Colorado. Hard Red Winter wheat is the main wheat variety grown in the United States.

Wheat starch: The portion of the wheat kernel remaining after the gluten has been extracted.