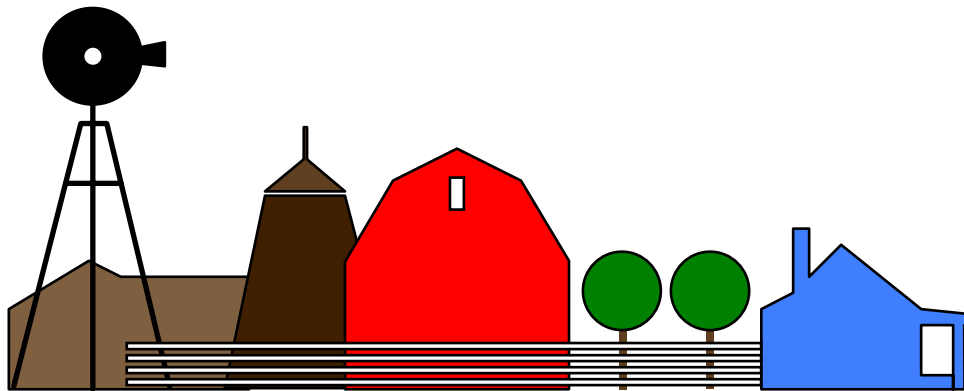


Crops Skills Development



2005-2010 Edition

**Written by: Mark G. Evans
Agronomy Department
Purdue University**

**Revised by: Bruce Sillery
Attica High School**

Table of Contents

	<u>Page</u>
Additional copies (information about)	3
Agronomy Exam Objectives	28-30
Agronomy Exam Section	26
Corn Grading	8-10
Corn Grading Table	16
Crop ID Lists	4
Disease & Damage ID Lists	5
Grain Grading Answer Sheet (Blank for duplication & practice)	21-22
Grain Grading Answer Sheet (Rules for filling out)	18
Grain Grading Handbook	8-15
Grain Grading Section	8
Grain Grading Table (Use)	15
Identification Section	4
Introduction	3
Plant Identification	6
Point Values	3
References Used for Agronomy Skills Development	31
Rules for Invitational, County, Area & State Crop Events	3
Sample Grain Grading Problems	23
Sample Grain Grading Answers	24-25
Sample Grain Grading Graded Answer Sheet	26-27
Scoring of Grain Grading	19-20
Scoring of Identification	4
Seed Identification	6-7
Soybean Grading	10-12
Soybean Grading Table	16
Weed ID Lists	4-5
Wheat Grading	13-15
Wheat Grading Table	17

INTRODUCTION

This publication "Agronomy Skills Development" has been prepared to aid agriculture science and business instructors, their students and 4-H members in preparing for crop events. It will also serve as the official rules and regulations for conducting 4-H and FFA events at the area and state levels in Indiana. Copies of this publication will be available on the Indiana FFA Website, IAAE website and hard copies can be obtained from Bruce Sillery, Attica High School.

This document was revised after the 2004-2005 Crops CDE season using any additions or corrections suggested by Agricultural Instructors. The document will be used for five years (2005-2010) before added to or changed in any way. Suggestions for change are due to the crops judging committee as of the 2009 State Crops Contest.

GENERAL RULES

1. The outline of the event and all rules included herein are official for the area and state events. There are two levels of participation: Junior or Senior.
2. The event is divided into three sections: (1) identification, (2) grain grading, and (3) agronomy exam.
3. The following point values are assigned to each section:

Section I Identification --		600
25 weed and crop plant samples	250	
25 weed and crop seed samples	250	
10 crop disease and damage factors	100	
Section II Grain Grading --		200
4 Corn samples	100	
2 Soybean samples	50	
2 Soft red winter wheat samples	50	
Section III Agronomy Exam --		200
40 multiple choice questions	200	_____
Total Possible Score		1000
- Ties will be broken in the following order: Section I, Section II, and finally Section III.
4. Participants are required to use clipboards while participating in the event. It is permissible for the participant to use a magnifying glass during the event.
5. A maximum of 60 minutes will be allowed for each section of the event. Twenty minutes will be allowed for each part of Section I: Plant ID, Seed ID, and Disease & Damage ID.
6. No communication with other participants, or with anyone else except the official in charge, will be permitted during the event.
7. ID 179, Corn & Soybean Field Guide may be used **ONLY** during the Agronomy Exam. No other information other than section markers is allowed to be placed within ID-179.

SECTION I - IDENTIFICATION

- The list of crops, weeds and disease and damage factors on the following pages will serve as the official list in preparing for any crops event. A plant or seed may be used more than once in a contest.
- Ten points will be deducted for each plant specimen, seed sample or disease/damage omitted or improperly identified. Plant specimen answer sheets are blue, seed specimen answer sheets are yellow and disease and damage sheets are pink.
- When no disease or damage is found in a sample a contestant should write the word "Sound" in the answer blank.
- In all three parts of the Identification Section, two points will be deducted for each correct answer incorrectly spelled and two points will be deducted for each correct answer incorrectly capitalized. The maximum deduction for each incorrectly written name is four points. (The names must be spelled exactly as they appear in the official lists below.)
- **Crops and weeds will NOT be separated in the plant or the seed identification.**

The following is a list of crop plants to be identified:

Alfalfa	Kentucky bluegrass	Smooth bromegrass
Alsike clover	Korean lespedeza	Soybean
Barley	Oat	Sudangrass
Birdsfoot trefoil	Orchardgrass	Sweetclover
Canola	Red clover	Tall fescue
Corn	Reed canarygrass	Timothy
Crownvetch	Rye	Wheat
Grain sorghum	Ryegrass	White clover
Hairy vetch		

The following is a list of crop seeds to be identified:

Alfalfa	Hairy vetch	Soybean
Alsike clover	Kentucky bluegrass	Sudangrass
Barley	Korean lespedeza	Sweetclover
Birdsfoot trefoil	Oat	Tall fescue
Canola	Orchardgrass	Timothy
Dent corn	Red clover	Triticale
Sweet corn	Reed canarygrass	Durum wheat
Popcorn	Rice	Hard red winter wheat
Crownvetch	Rye	Soft red winter wheat
Flax	Ryegrass	White wheat
Grain sorghum	Smooth bromegrass	White clover

The following list of *weeds* (seed and plant unless specified) are to be identified

Barnyardgrass	Canada thistle
Bindweed (Seed only)	Cheat
Bitter wintercress	Common cocklebur (Seed as a bur)
Buckhorn plantain	Common lambsquarters
Burcucumber (Seed as a bur)	Common milkweed (Seed only)

Common ragweed
 Curly dock
 Dandelion
 Downy brome
 Eastern black nightshade
 Fall panicum
 Field bindweed (Plant only)
 Field pennycress
 Field pepperweed
 Giant foxtail
 Giant ragweed
 Green foxtail
 Hedge bindweed (Plant only)
 Hemp dogbane (Plant only)
 Horsenettle
 Horseweed
 Ivyleaf morningglory (Plant only)
 Jerusalem artichoke (Plant only)
 Jimsonweed

Johnsongrass
 Large crabgrass
 Morningglory (Seed only)
 Oxeye daisy
 Pennsylvania smartweed
 Perennial sowthistle
 Quackgrass
 Redroot pigweed
 Shepherdspurse
 Tall morningglory (Plant only)
 Trumpet creeper
 Velvetleaf
 Wild buckwheat
 Wild carrot
 Wild garlic
 Wild mustard
 Yellow nutsedge (Plant only)

The following types of disease and damage frequently occur in grain crops and result in considerable yield and quality losses. The list tells whether the sample will be a grain sample or photo and also identifies the type of crop it is found in for this contest:

Disease or damage	Crop	Type of sample
Blacktip	Wheat	Grain sample
Blue eye mold	Corn	Grain sample
Ergot	Wheat	Grain sample
Green damage	Soybean	Grain sample
Heat damage	All	Grain sample
Insect damage	All	Grain sample
Purple seed stain	Soybean	Grain sample
Smut	Wheat	Grain sample
Sprout damage	All	Grain sample
Wheat scab	Wheat	Grain sample
Sound	All	Grain Sample
Nitrogen deficiency	Corn	Photo
Phosphorus deficiency	Corn	Photo
Potassium deficiency	Corn	Photo
Manganese deficiency	Soybean	Photo
Gray leaf spot	Corn	Photo
Northern corn leaf blight	Corn	Photo
White mold	Soybean	Photo
Brown spot	Soybean	Photo
Sudden death syndrome	Soybean	Photo
Brown stem rot	Soybean	Photo
Common rust	Corn	Photo

PLANT IDENTIFICATION

The identification of plant specimens is essential for an environmentally and economically friendly weed control program. A pest control program will be effective only if the farmer can identify seedling weeds and crops. Weed species often vary according to a producer's cultural practices and tillage system. Crop fields that are switched to no-till tend to have more large-seed weeds over time. Small-seeded weeds are more common in tilled fields. When identifying plants, some of the following distinguishing points may be helpful.

Stems & Leaves - A grass leaf consists of five distinct structures: sheath, collar, auricles, ligule, and blade. The sheath is a tube-like structure connecting the leaf to the stem at a node. The leaf blade is narrow and ribbon-like, connected to the sheath at the collar. On some grasses, a membranous extension of the sheath, called the ligule, is present. Claw like outgrowths of the collar, called auricles are helpful in identifying other species.

While all grasses have simple leaves, most legumes have compound leaves (each leaf is composed of two or more leaflets). In addition to a leaflet, a petiole and stipules (small bracts at the base of the petiole) are parts of a legume leaf. Leaf margins may be serrated, as in Sweetclover, spined as in Canada thistle, smooth as in Alsike clover, or hairy as in Red clover.

Some plants are identified by observing the plant's stem. White clover has stolons and stems extend laterally whereas Alsike clover has an grows upright with its stem. Some plants have hollow stems while others have solid stems. Weeds found in no-till systems are more likely to have stems which are woody.

Broadleaf Flowers - The inflorescence (flowering portion of a plant) is often the most distinctive characteristic of a plant. The flower of a broadleafed plant, such as a legume, generally has sepals and petals. The number and shape are usually similar, but size and color will vary among species. All legumes have 5 flower petals. The arrangement of flowers within an inflorescence is also helpful; for example, Alfalfa and Sweetclover have raceme inflorescence, and Red clover and Alsike clover have head type inflorescence.

Grass Flowers - The grass flower (which is replaced by the kernel at maturity) is enclosed within the lemma and paella. This entire structure is called a floret. One or more florets are usually grouped together between a pair of glumes, thus forming a spikelet. The arrangement of the spikelets on the rachis (central axis of the inflorescence) varies among species. The spikelets are attached directly to the rachis of a Wheat spike, but are borne on branches of a panicle of Oat. In addition, an awn may arise from the lemma of certain grasses. Other important considerations include the number of florets per spikelet, the number of spikelets per rachis node, the mode of attachment of the rachis, and the size of the lemma, palea, glumes, and awn.

Roots - Grasses generally have a fibrous root system while broadleaf plants generally have a tap root or branching tap root system. Some perennial grasses like Quackgrass and Johnsongrass have modified underground stems called rhizomes that look like roots. Some perennials like Canada thistle and Field bindweed have creeping, lateral root systems. One can distinguish roots from stems by looking for nodes. All stems have nodes which are the origin of a leaf.

All of these factors and others may contribute to the identification of plant specimens.

SEED IDENTIFICATION

Knowledge of buying good seed and producing good seed is essential to produce top profits. Seed producers must know the quality of their seed in order to market it, to price it correctly, and to meet the requirements of the Indiana Seed Law. When identifying seed, some of the following distinguishing points may be helpful:

Size and Shape - The size of the seed is important in distinguishing such seeds as Oat and Rye. The shape is important when distinguishing seed of Hard red winter wheat from Soft red winter wheat and seed of Alfalfa from Sweetclover.

Color - Color cannot be used to distinguish between seeds of Alfalfa and Sweetclover, but it is very useful for distinguishing the seed of Alsike clover from White clover.

Seed Surface Texture - Some seeds like Triticale and Jimsonweed are very rough. Other seeds like Redroot pigweed and Johnsongrass are very smooth.

Special Structures and Coverings - Some grass seeds like Oat, Tall fescue, and ryegrass retain their lemmas and paleas after threshing. Some grass seeds like Wheat, Rye, and sometimes Timothy thresh free. Some grass seeds like Tall fescue and Ryegrass have a stem-like structure at the base of the seed on the grooved side. This structure is called the rachilla and the size and shape of the rachilla is useful in distinguishing between certain grasses. For example, Johnsongrass seeds have knobbed rachilla while Sudangrass seed have two rachilla with broken, irregular tips. Grass plants that have only one floret per spikelet, such as Reed canarygrass, do not have a rachilla. Some seeds such as Cheat and Downy brome retain their beard or awn after threshing. Seeds like Korean lespedeza are frequently enclosed within an outer covering or hull. Legume seeds during development are attached to the pod at the hilum. This point of attachment is frequently useful in identification, especially in Soybean. A cultivar may be described by its hilum color.

IMPORTANT WHEN RUNNING A CONTEST

Wild mustard and Canola seed as well as Giant foxtail and Green foxtail seed will never be in the same event. When used in contests, participants will be told which ones are not in the event when necessary. Also, when a Giant foxtail plant is exhibited, the officials will tell contestants that there are hairs on the upper side of the leaves.

SECTION II - GRAIN GRADING

What is GRAIN GRADING?

The 2004 agricultural statistic estimates indicate that Indiana farmers grew approximately 5.7 million acres of Corn, 5.55 million acres of Soybeans, and 450 thousand acres of Wheat. Almost 75 percent of this grain enters the market channels and is sold as a cash crop. The remaining 25 percent, mostly Corn, is utilized as a feed grain.

Regardless of the manner of handling, many sales and purchases are conducted which require knowledge of the market grades by both the buyer and seller. For instance, most of the marketed Corn changes hands on the basis of U.S. No. 2 Yellow Corn. Market reports, either by television, radio, or newspaper, are usually in terms of the "U.S. No. 2 Yellow Corn." Soybeans however are usually reported in terms of "U.S. No. 1 Yellow Soybeans." With the widespread use of price quotations, it is essential that agricultural students be familiar with the quality factors which serve as a basis for the federal grain grading standards. These factors are also used in the preparation of discount schedules which are widely used in determining the prices which are paid to farmers.

Once the farmer becomes aware of the quality factors which determine the grade of grain, the value of the grain from the farm may be calculated from market quotations. This will aid one in deciding whether further handling as needed to secure a higher grade would be profitable to him/her.

This event will be concerned with the grading of Corn, Soybeans, and Wheat. Grading standards have also been established for Barley, Canola, Oats, Rye, Sorghum, Flax, other Wheat classes, Triticale, Sunflower, and mixed grains.

GRAIN GRADING HANDBOOK

CORN GRADING

Corn is defined as any grain which consists of 50 percent or more of whole kernels of shelled dent corn and/or flint corn. It may not contain more than 10 percent of other grains for which grading standards have been established. If it does not meet these standards, the lot is considered mixed grain. However, in this event there will be no mixed grain so any grain other than dent or flint corn is foreign material. Popcorn and sweet corn in corn grading are foreign material.

Class and damaged kernels are determined after the removal of foreign material. All percentages shall be determined on the grain as a whole.

The first step is to determine the correct class. There are three classes of corn:

Yellow Corn - Yellow-kerneled corn that does not contain more than 5 percent corn of other colors. Yellow kernels with a slight tinge of red are considered yellow corn.

White Corn - White-kerneled corn that does not contain more than 2 percent corn of other colors. White corn with a slight tinge of pink is white corn.

Mixed Corn - Corn that does not meet the color requirements of white or yellow corn. When completing the grain inspection certificate (answer sheet) record the percent of each corn (class) from greatest to least in percentage to nearest tenth within the "Remarks" section. For example, **Yellow Corn 80.0%, White Corn 20.0%** Proper spelling, capitalization and inclusion of the tenths spot and percent mark is necessary.

Examples of class determination:

<u>Problem</u>	<u>Correct class</u>
1. 95% yellow corn = 5% white corn	Yellow Corn
2. 98% white corn = 2% yellow corn	White Corn
3. 96% yellow corn = 4% white corn	Yellow Corn
4. 89% yellow corn = 11% white corn	Mixed Corn

Moisture - is not a grading factor in commercial grain; nevertheless, a loss of quality in stored corn hinges largely on the amount of moisture present in the grain. Moisture is an important factor in most discount schedules. Moisture is recorded on the grain certificate (answer sheet) to the nearest tenth of a percent. **(e.g. 16.27% recorded as 16.3%).**

Factors used in determining the grade are as follows:

Test Weight - The amount of weight the grain must have to make up a bushel. Good quality corn of low moisture content can be expected to have a good test weight. Record test weight to the nearest tenth. Example **52.34 lbs/bu is recorded as 52.3 lbs/bu.**

Broken Corn and Foreign Material - This factor is normally determined by the use of a sieve; broken corn and all matter other than corn that pass through a sieve having round openings 12/64th of an inch in diameter, and all matter other than corn that remain on the sieve after screening are included in this factor. Sweet corn and popcorn are forms of foreign material in corn grading. Soybeans not passing through the sieve would be an example of foreign material as well as wheat or oats that would drop through the screen. Rodent excreta and stones are also part of Broken Corn and Foreign Material. Do not enter this percentage in the foreign material column on the answer sheet. There is a column for Broken Corn and Foreign Material. Record to nearest tenth of a percent.

Heat-damaged Kernels - Heat damaged corn is severely discolored (brown to black) either from external heating, such as improper drying, or from heating as a result of excessive moisture in storage and spoilage. This differs from slightly damaged by heat in that severe heat damage discolors the entire kernel. Slightly damaged corn shows some discoloration (light to dark tan) and therefore is not as severely damaged. The two are not added together to determine heat damaged kernels. Slightly heat damaged kernels would be added to Damaged Kernels (Total). Record to the nearest tenth of a percent.

Damaged Kernels (Total) - This factor includes all types of damage found in corn. Darkening of the germ is one of the first indicators of corn declining in quality or that the amount of damage is increasing. Damaged Kernels (Total) includes: mold damage, heat damage, sprout damage, frost damage, badly ground-damaged, badly weather-damaged, some forms of insect damage, and kernels that have become slightly discolored from heat. Note that the percent of heat damage is added to other types of damage to obtain the percent of Damaged Kernels (Total). Record Damage Kernels (Total) to the nearest tenth of a percent.

Stones - If the total weight of stones in a 1-1/4 quarts (1,000 gm.) sample exceeds 0.1 percent of the sample weight, the sample must be graded "U.S. Sample Grade". Cinders are considered Stones. When applicable, record "**Stones**" in the "Remarks" section of the certificate.

Musty, Sour or Heating - A sample in any of these conditions is "U.S. Sample Grade". These conditions include mold smell, fermentation, pig pen smell, etc. Record the applicable words in the "Remarks" section of the grading certificate. For example, "**Musty**" or "**Sour**".

Commercially Objectionable Foreign Odor - If the corn carries an odor which does not normally occur in grain and which, for this reason, would render the corn unfit for its normal commercial use, then it is graded "U.S. Sample Grade". This includes animal hides, decaying animal or vegetable parts, fertilizer, skunk, smoke, strong weed, oil, etc. Record the words "**Commercially Objectionable Foreign Odor**" in the "Remarks" section of the certificate.

Distinctly Low Quality - The Federal Grain Inspection Service reserves the use of this term to describe corn when it is obviously of inferior quality and the existing grading factors or guidelines do not accurately reflect the inferior condition. Grain Inspectors are advised to use all available information to determine whether corn is of Distinctly Low Quality. When a sampler is collecting corn from a rail car, he/she can notice whether the grain also includes two or more large stones, pieces of glass, pieces of concrete, sticks of lumber, or scrap metal or debris which are visible to the sampler but are too large to enter the sampling device, such as a grain probe. To illustrate, corn is described as containing "plywood scraps". From information above, the corn would be designated: **Distinctly Low Quality (Plywood Scraps)**. This grading factor should not be confused with the other conditions which can also cause corn to be "Sample Grade", such as Animal Filth, Cocklebur, Crotalaria seed, etc. Here, the participant would compare limits shown in the corn grading table under Sample Grade. Example: 0.3% Animal Filth. Since this quantity exceeds the 0.2% allowable, then the grading factor would be: Animal Filth. A quantity as 0.3%, or 3 per 1000 gm., to follow "Animal Filth" is not required. Record the words "Distinctly Low Quality" and the reason(s) in the "Remarks" section of the certificate.

Sample Grade Factors – There are a list of factors that automatically make the sample "sample grade" listed on the bottom of the grading chart. These include Animal Filth, Cocklebur, Crotalaria seed. If any of these are reported in the sample, contestants should grade the sample "sample grade" and write the word in the "Remarks" box. For example, "**Animal Filth**", "**Cocklebur**" or "**Crotalaria**" Quantity of material is not required.

Special factors, special grade requirements, and special grade designations are as follows:

Flint - Corn of any class which consists of 95 percent or more of flint corn; flint corn is graded and designated according to the grade requirements of the standards applicable to such corn if it were not flint, and the word "Flint" is added to and made a part of the grade designation, immediately following the class name. For example. **U.S. No. 4 Yellow Corn, Flint**

Flint and Dent - Corn of any class which consists of a mixture of flint and dent corn containing more than 5 percent but less than 95 percent of flint corn; flint and dent corn are graded and designated according to the grade requirements of the standards applicable to such corn if it were not flint and dent, and the words "Flint and Dent" and the percentage of flint corn rounded to the tenth are added to and made a part of the grade designation immediately following the special grade. Example: **U.S. No. 3 Yellow Corn, Flint and Dent, Flint Corn 27.0%**.

Infested - Any corn sample 1-1/4 quarts or 1000 gm. that contains two or more live weevils, one live weevil and 5 or more other live insects injurious to stored grain, or 10 or more other live insects injurious to stored grain is considered infested. Infested corn is graded and designated according to the grade requirements of the standards applicable to such corn if it was not infested. The word "Infested" is added to and made a part of the grade designation. Example: **U.S. No. 2 White Corn, Infested**

Waxy Corn - Corn that consists of 95% or more waxy corn. When applicable, this special grade will be last within the grade designation. Example: **U.S. No. 2 White Corn, Waxy**

Special grades are conditions which should be noted but do not affect the numerical grade. The special grades "Flint" and "Flint and Dent" denote amounts of flint corn in the sample. Flint corn is a different subspecies of corn with hard starch rather than soft starch as in dent corn. Infested is the condition of live weevils or grain-damaging insects in the grain.

SOYBEAN GRADING

Soybeans are any grain that consists of 50 percent or more of whole or broken soybeans which will not pass readily through an 8/64 sieve and not more than 10 percent of other grains for which grading standards have been established. Class, splits, damaged kernels are determined after foreign material is removed. Soybeans are divided into the following two classes:

Yellow Soybeans - Soybeans that have a yellow seed coat and are yellow in cross-section. Up to 10 percent of other colors are allowed in Yellow Soybeans.

Mixed Soybeans - Any mixture of soybeans that does not meet the requirements of Yellow Soybeans. See Soybeans of Other Colors. For Mixed Soybeans, record the percentage of each color of soybeans, listing them from greatest to least and rounded to the nearest tenth in the "Remarks" section of the certificate. Example: **Bi-colored Soybeans 74.6%, Yellow Soybeans 25.4%**.

Moisture - The moisture content of soybean seed is extremely important but it is no longer used as a grading factor. Loss of quality of stored seed hinges largely on the amount of moisture present in the sample. Moisture is an important factor in most discount schedules. Record moisture to the nearest tenth of a percent.

Factors considered in determining the grade of soybeans are as follows:

Test Weight - Good quality seed of low moisture content can be expected to have a good test weight. Record test weight rounded to the nearest tenth. Example **56.78 lbs/bu is recorded as 56.8 lbs/bu**.

Splits - Any soybean having more than 1/4 of the seed missing is considered a split. This factor includes only **sound splits** - those free from damage. See Damaged Kernels (Total) below. Splits are determined on a portion of approximately 125 grams after the removal of all foreign material. Splits are recorded to the nearest tenth of a percent. (**e.g. 16.26% is recorded as 16.3%**).

Damaged Kernels (Total) - This factor includes all types of damage found in whole and pieces of soybeans (Splits). Damaged Kernels (Total) includes the following: heat damage, sprout damage, frost damage, immature seed, ground-damage, mold damage, insect damage, and seeds that have become slightly discolored by heat, etc. Note that the percentage of heat damage is added to the percentage of other types of damage to obtain the percentage of Damaged Kernels (Total). Stink bug stung kernels are considered damaged kernels at the rate of 1/4 of actual total percentage of stung kernels (e.g. 12 % is considered as 3% of damage). Use the publication "Soybean Kernel Damage" (#215 O.S.U.) to help you make these determinations. Record Damage Kernels (Total) to the nearest tenth of a percent.

Heat-damaged Kernels - Soybeans that are severely discolored (black or dark brown) either from external heating, such as improper drying, or from heating as a result of excess moisture and spoiling. Almost all heat damage is the result of storing grain too wet. Use the publication "Soybean Kernel Damage" (#215 O.S.U.) to help you make this determination. Record Heat-damaged Kernels to the nearest tenth of a percent. Any slightly discolored by heat damage is not considered Heat Damage, but is added to Damaged Kernels (Total) as it is in Corn.

Foreign Material – Both coarse and fine foreign material are added together to determine this factor

Coarse Foreign Material - This includes kernels of corn, cockleburs, sticks, stalks, etc that do not pass through an 8/64 inch sieve. This test is made on 1000 grams. This percentage must be added to Fine Foreign Material. The sum of the two foreign materials is recorded to the nearest tenth of a percent.

Fine Foreign Material - This includes anything such as rodent excreta and stones that pass through an 8/64 inch sieve including soybeans and pieces of soybeans plus all matter other

than soybeans that remain on the sieve after sieving. This test is made on 125 grams. This percentage must be added to Coarse Foreign Material. The sum of the two foreign materials is recorded to the nearest tenth of a percent.

Soybeans of Other Colors - These colors serve as a grading factor in Yellow Soybeans. When soybeans of other colors (black, brown, and bi-colored) occur in quantities of 10 percent or less, the percentage is a factor in determining the grade of Yellow Soybeans. When other colors exceed 10 percent, the sample is then classified as Mixed Soybeans (see above). Soybeans of Other Colors is listed in the "Remarks" section. For example, **Soybeans of Other Colors 9.5%**

Stones - If four or more stones are present in a sample of 1-1/4 quarts (1000 gm.) **and** the total weight of Stones exceeds 0.1 percent of the sample weight, the sample must be graded "U.S. Sample Grade." Cinders are considered Stones. When applicable, record "**Stones**" in the "Remarks" section of the certificate. The number of Stones is not needed.

Distinctly Low Quality - The description as shown for corn applies to the presence of such conditions in soybeans.

Heating - The description for corn also applies to the presence of this condition in soybeans.

Cumulative Total - If a cumulative total of 11 or more sample grade factors (e.g. 3 stones + 2 animal filth + 6 unknown = 11 or more sample grade factors) are found, the sample is graded "U.S. Sample Grade." These factors include any combination of Animal Filth, Castor Beans, Crotalaria seeds, Glass, Stones, and any Unknown Foreign Substance. When applicable, record "**Cumulative Total**" in the "Remarks" section. You are not required to list the factors that cumulate to this total.

Special factors, special grade requirements, and special grade designations are as follows:

Purple Mottled or Stained - Soybean samples which in general appearance are 2% or more purple mottled or purple stained or in general appearance are 2% or more discolored by dirt or dirt-like substances are considered to be "Purple Mottled or Stained." This determination is made on 125 grams. A soybean kernel must have 50% or more of its surface discolored to be considered. When applicable "Purple Mottled or Stained" is added to and made part of the grade designation on the certificate. For example, **U.S. No. 2 Yellow Soybeans, Purple Mottled or Stained**

Garlicky - Soybeans that contain five or more green garlic bulblets or the equivalent of dry garlic bulblets in 1000 grams are considered garlicky. Garlicky soybeans are graded and designated according to the grade requirements of the standards applicable to such soybeans if they were not garlicky and the word "Garlicky" is added to and made part of the grade designation. Three dry bulblets are equal to one green bulblet. A garlic odor is not a basis for "Garlicky." For example, **U.S. No. 2 Yellow Soybeans, Garlicky**

Infested - Soybeans which contain two or more live weevils, one live weevil and five or more other live insects injurious to stored grain, or 10 or more other live insects injurious to stored grain in the sample are considered "Infested." Infested soybeans are graded and designated according to the grade requirements of the standards applicable to such soybeans if they were not infested. The word "Infested" is added to and made part of the grade designation. Ex. **U.S. No. 3 Yellow Soybeans, Infested**

The special grades "Garlicky", "Infested" and "Purple Mottled and Stained" do not affect the numerical grade. They are treated similarly to the special grades which are applicable to corn.

WHEAT GRADING

Wheat is any grain of common wheat, club wheat, and durum wheat, which before the removal of dockage, consists of 50 percent or more of these wheats and not more than 10 percent of other grains for which standards have been established and which, after the removal of dockage, contains 50 percent or more of whole kernels of one or more of these wheats. Wheat is divided into the following seven classes: Hard Red Spring Wheat, Durum Wheat, Soft Red Winter Wheat, Hard Red Winter Wheat, White Wheat, Unclassed Wheat, and Mixed Wheat. However, Soft Red Winter Wheat is the only wheat class that will be graded in this event, and the following discussion will pertain only to Soft Red Winter Wheat. The class Soft Red Winter Wheat includes all varieties of Soft Red Winter Wheat. There are no subclasses in this class.

Basis of Determination

Each determination of dockage, moisture, temperature, odor, garlic, live weevils or other insects injurious to stored grain, and distinctly low quality completed on the grain as received when taken from an incoming truck, rail car, etc. All other "tests" are conducted after dockage has been removed. Moisture is recorded to the nearest tenth of a percent (**e.g. 17.34 is recorded as 17.3%**).

Dockage - The word "Dockage" means weed seed, weed stems, chaff, straw, grain other than wheat, sand, soil, and any other material other than wheat, that can be removed readily from the wheat by the use of appropriate sieves and cleaning devices. Also, the underdeveloped, shriveled, and small pieces of wheat kernels removed in properly separating the material other than wheat plus that which cannot be recovered by properly rescreening or recleaning is also a part of Dockage. Determination of Dockage is made in the initial sieving. Shrunken and Broken Kernels and Foreign Material are determined after the Dockage has been removed. The percent Dockage is rounded and reported to the nearest tenth percent. Dockage is determined from a 1,000 gram sample. Always list Dockage last of all of the special factors. Example: **U.S. No 2 Soft Red Winter Wheat, Smutty, Dockage 2.4%**

Factors to be considered in determining the grade of Soft Red Winter Wheat are as follows:

Foreign Material - Foreign material refers to all matter other than wheat, including stones, that is not separated from the wheat in the proper removal of Dockage. Record to the nearest tenth of a percent.

Damaged Kernels (Total) - This factor includes all types of damage found in wheat. It is very inclusive in that kernels and pieces of kernels of **wheat plus other grains (Ex. Sprout-damaged Oats)** are also included. Damaged Kernels (Total) means heat-damaged, sprouted, frosted, badly ground-damaged, badly weather-damaged, moldy, diseased, or otherwise materially damaged. Note that the percentage of heat damage is added to become a part of the Damaged Kernels (Total). Damaged Kernels (Total) are recorded to the nearest tenth of a percent. Use the "Wheat Kernel Damage" publication #L-213 from O.S.U. to help you make these determinations.

Heat-damaged Kernels - Refers to kernels and pieces of kernels of **wheat and other grains** that have been "severely" discolored or damaged by heat. This damage may result from external heating, such as improper drying, or from heating as a result of excess moisture and spoilage. Heat-damaged kernels are reported to the nearest tenth of a percent. Use the "Wheat Kernel Damage" publication #L-213 from O.S.U. to help you make this determination. Slightly discolored wheat kernels are considered to only be Damaged Kernels (Total) and added to that total as in Corn and Soybeans.

Other Grains - Other grains as used in this discussion are rye, oats, corn, grain sorghum, barley, flax, emmer, spelt, einkorn, polish wheat, poulard wheat, cultivated buckwheat, and soybeans. These grains are also considered foreign material, even when damaged.

Insect Damaged Wheat Kernels - Wheat is determined to be U.S. Sample Grade when 32 or more insect damaged kernels per 100 grams are found. This is up to a 3 stage process. For simplicity in this event, the number of kernels per 100 gram will be given. Do not confuse insect chewed with

insect damage. When applicable, include in the "Remarks" section of the certificate "**Insect Damaged Kernels**"

Contrasting Classes - A contrasting class in Soft red winter wheat is Durum wheat. Soft red winter wheat flour is especially suited for cake mixes while flour from Durum wheat is required for spaghetti production. Thus, there is a "contrast" in use. White Wheat has Durum, Hard Red Winter, Hard Red Spring and Soft Red Winter Wheat as contrast classes. Each wheat has its own "Contrasting Classes." Record in "Remarks" area of certificate "Contrasting Classes" and state to the nearest tenth of a percent. Example: **Contrasting Classes 4.3%**

Wheat of Other Classes (Total) - This factor spotlights the presence of other wheats in a sample. Some mixtures may be of minor importance. For example, if a Soft red winter wheat contained 8% Hard red winter wheat, the flour from such a mixture might be acceptable, but not the most desirable for cake mixes when compared to flour from 100% Soft red winter wheat. Wheat of Other Classes (Total) also includes percent of Contrasting Classes. State "Wheat of Other Classes (Total)" (Total to nearest tenth of a percent) in the "Remarks" section of the certificate. Example: **Wheat of Other Classes (Total) 2.5%**

Distinctly Low Quality - The description as shown for corn applies to the presence of such conditions in wheat. Large pieces of concrete, metal, glass, etc. are the bottom line in assigning "Sample Grade" to wheat.

Shrunken and Broken Kernels - These are kernels and pieces of kernels of wheat and other matter that will pass readily through a .064 x 3/8 inch oblong hole sieve after the dockage has been removed. Record to the nearest tenth of a percent.

Stones and Glass - If four or more Stones are present in a sample of 1-1/4 quarts (1,000 gm.) **or** the total weight of the stones exceeds 0.1 percent of the sample weight, the sample must be graded "U.S. Sample Grade". Cinders are considered Stones. Wheat will be graded "U.S. Sample Grade" when one or more pieces of Glass are found per 1000 grams. Record "**Stones**" **or** "**Glass**" respectively, when applicable in the "Remarks" section of the certificate. Quantity of material is not needed.

Cumulative Total - If a cumulative total of 5 or more sample grade factors (e.g. 3 Stones + 1 Animal Filth + 1 Unknown Foreign Substance = 5 or more sample grade factors) are found, the sample is graded "U.S. Sample Grade." Record "**Cumulative Total**" in the "Remarks" section.

Defects (Total) - This factor is determined by adding the percentages of Damaged Kernels (Total), Foreign Material, Shrunken and Broken Kernels.

Test Weight - Good quality wheat of low moisture content can be expected to have a good test weight. The weight per bushel is expressed to the nearest tenth of a pound. For example, **60.18 is reported as 60.2 lbs.**

Special factors, special grade requirements, and special grade designations are always listed in alphabetical order with Dockage listed last and are as follows:

Smutty - There are two special grades of smutty wheat -- Light Smutty and Smutty.

Light Smutty - Applies to wheat with a smutty odor, or when wheat contains 6-30 smut balls in 250 grams of grain; the term "Light Smutty" is added to and made part of the grade designation. For example, **U.S. No 3 Soft Red Winter Wheat, Light Smutty**

Smutty - Applies to wheat that contains 31 or more smut balls per 250 gram sample; the word "Smutty" is added to and made part of the grade designation. **U.S. No 3 Soft Red Winter Wheat, Smutty**

Garlicky - Wheat that contains three or more green garlic bulblets or an equivalent of dry bulblets in a 1000-gram sample; the word "Garlicky" is added to and made part of the grade designation. Three dry or partly dry bulblets equal 1 green garlic bulblet. Garlic odor is not a basis for "Garlicky." **U.S. No 3 Soft Red Winter Wheat, Garlicky**

Infested - Wheat that is infested with two or more live weevils, one live weevil and one or more other insects injurious to stored grain, or two or more other insects injurious to stored grain in a 1-1/4 quart (1,000 gm.) sample is considered infested. Wheat that is infested is graded and designated according to the grade requirements of the standards applicable to such wheat if it were not infested. The word "Infested" is added to and made part of the grade designation. **U.S. No 3 Soft Red Winter Wheat, Infested**

Ergoty - Wheat that contains more than 0.05 percent per 1000 grams ergot is considered Ergoty. Ergoty wheat is graded and designated according to the grade requirements of the standards applicable if it were not "Ergoty". The word "Ergoty" is added to and made part of the grade designation. Note that ergot also fits the definition of foreign material in wheat and must be included as such. **U.S. No 3 Soft Red Winter Wheat, Ergoty**

Treated Wheat - Wheat that has been scoured, limed, washed, sulphured or treated with a substance such that the grade designation alone does not truly describe its quality. Wheat that is "Treated" will have the words "Treated (Treatment(s))" as part of the grade designation (e.g. **U.S. No. 1 Soft Red Winter Wheat, Treated (Limed), Dockage 0.4%**).

These six special grades and dockage are treated similarly to the special grades in corn and soybeans in that they do not affect the numerical grade, but they are written as a part of the grade designation following the class.

HOW TO USE THE GRADE REQUIREMENT TABLES FOR GRAIN GRADING

Notice on the grain grading chart (green sheet) that there are two categories at the top: minimum limits and maximum limits.

The minimum limits pertain to test weight. No. 1 corn can have a test weight of 56 pounds. This means that for a corn sample to be No. 1 (all other factors being No. 1) it must weigh at least 56 pounds. It can weigh more, but it cannot weigh less. If the weight is 55.9 pounds, it cannot be No. 1 corn; it must be No. 2. No. 2 corn must weigh not less than 54 pounds, and No. 3 corn cannot weigh less than 52 pounds, etc.

Maximum limits are given for the remaining factors. This means that a sample cannot contain more than a given maximum percentage of a given factor. For example, for a sample of corn to be No. 1, it cannot have more than 2.0 percent Broken Corn and Foreign Material. If it has 2.1 percent, it must be graded No. 2. No. 2 corn cannot contain more than 3.0 percent BCFM. If it contains 3.1 percent BCFM, it must be graded No. 3, etc.

The factor resulting in the lowest grade determines the grade for the lot of grain. For example, a sample of soybeans with a test weight of 51 pounds per bushel would be graded U.S. No. 4, although all other factors may qualify the sample for U.S. No. 1. The grade then would be U.S. No. 4 because of the low test weight. If, for any reason, the sample fails to make any of the numerical grades, the sample is graded "U.S. Sample Grade". Example: If corn weighs less than 46 lb per bushel, has more than 7 percent Broken Corn and Foreign Material, 15 percent Damaged Kernels (Total), or 3.0 percent Heat-damaged Kernels, it is graded "Sample Grade". Factors for which any sample is automatically graded as Sample Grade are: Commercially Objectionable Foreign Odor, Distinctly Low Quality, Musty, Sour, Heating, and Stones.

The procedure in the previous paragraph is followed for all grains, including corn, soybeans, and wheat.

Grades & Grade Requirements for Corn

Maximum limits of --

Grade	Minimum Test Weight per Bushel	<u>Damaged Kernels</u>		Broken Corn and Foreign Material
		Heat- damaged Kernels	Total	
	lbs	%	%	%
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:

U.S. Sample Grade shall be corn that:

- a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4, or 5; or
- b) Contains Stones which have an aggregate weight in excess of 0.1 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(s), 8 or more Cockleburs (*Xanthium* spp.) or similar seeds singly or in any combination, or Animal Filth in excess of 0.2 percent in a 1000 g. sample; or
- c) Has a Musty, Sour, or Commercially Objectionable Foreign Odor; or
- d) Is Heating or otherwise of Distinctly Low Quality

Grades & Grade Requirements for Soybeans

Maximum limits of -

Grade	Minimum Test Weight per Bushel	Heat- damaged Kernels	Damaged Kernels (Total)	Foreign Material	Splits	Soybeans of Other Colors
						1/
	lbs	%	%	%	%	%
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 Grad

U.S. Sample Grade shall be soybeans that:

- a) Do not meet the requirements for U.S. No. 1, 2, 3, or 4; or
- b) Contain four or more Stones are present in a sample of 1-1/4 quarts (1000 gm.) **and** the total weight of Stones exceeds 0.1 percent of the sample weight, 1 or more pieces of Glass, 3 or more *Crotalaria* seeds (*Crotalaria* spp.), 2 or more Castor Beans (*Ricinus communis*), 4 or more pieces of an Unknown Foreign Substance(s) or a Commonly Recognized Harmful or Toxic Substances, 10 or more rodent pellets, bird droppings, or an equivalent quantity of other Animal Filth in 1,000 grams of soybeans, or
- c) a Cumulative Total of 11 or more of any combination of these sample grade factors, or
- d) Have a Musty, Sour, or Commercially Objectionable Foreign Odor (except garlic odor), or
- e) Are Heating or otherwise of Distinctly Low Quality

1/ Disregard for Mixed Soybeans

Grades and Grade Requirements for Wheat

Grade	Minimum limits -- Test weight per bushel		Maximum limits of -					Wheat of Other Classes ^{3/}	
	Hard Red Spring Wheat or White Club Wheat (pounds)	All Other Classes and Subclasses (pounds)	Heat-damaged Kernels (percent)	Damaged Kernels (Total) 1/ (percent)	Foreign Material (percent)	Shrunken and Broken Kernels (percent)	Defects (Total) 2/ (percent)	Contrasting Classes (percent)	(Total) ^{4/} (percent)
U.S. No. 1	58.0	60.0	0.2	2.0	0.4	3.0	3.0	1.0	3.0
U.S. No. 2	57.0	58.0	0.2	4.0	0.7	5.0	5.0	2.0	5.0
U.S. No. 3	55.0	56.0	0.5	7.0	1.3	8.0	8.0	3.0	10.0
U.S. No. 4	53.0	54.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
U.S. No. 5	50.0	51.0	3.0	15.0	5.0	20.0	20.0	10.0	10.0

U.S. Sample Grade:

U.S. Sample Grade shall be wheat which:

- a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4, or 5; or
- b) Contains four or more Stones are present in a sample of 1-1/4 quarts (1,000 gm.) **or** the total weight of the Stones exceeds 0.1 percent, 1 or more pieces of Glass, 3 or more Crotalaria seeds (*Crotalaria* spp.), 2 or more Castor Beans (*Ricinus communis*), 4 or more particles of an Unknown Foreign Substance(s) or a Commonly Recognized Harmful or Toxic Substance(s), or 2 or more rodent pellets, bird droppings, an equivalent quantity of other Animal Filth per 1,000 grams of wheat; or
- c) a Cumulative Total of 5 or more of these items; or
- d) Has a Musty, Sour, or Commercially Objectionable Foreign Odor (except smut or garlic odor); or
- e) Is Heating or otherwise of Distinctly Low Quality, or
- f) Contains 32 or more Insect Damaged Kernels per 100 grams of wheat.

1/ Includes Heat-damaged Kernels.

2/ Defects (Total) include Damaged Kernels (Total), Foreign Material, and Shrunken and Broken Kernels. The sum of these three factors may not exceed the limit for defects.

3/ Unclassed wheat of any grade may contain not more than 10 percent of wheat of other classes.

4/ Includes Contrasting Classes.

Completing the Grain Grading Certificate

There are three major sections (lines) on the answer sheet: the grade line, the grading factors line, and the remarks section.

Grade Line

On the grade line first write the grade number (1, 2, 3, 4 etc.) following the words "U.S. No." which appear on the grade line. If the sample is determined to be Sample Grade, place an "X" through "No." and write "Sample Grade" rather than a number. Next the class is written following the grade number (Example: Yellow Corn). Then when applicable, any special grades such as "Infested" are listed in alphabetical order. Dockage is always listed last for all wheat samples. See example below for correctly written grade line (*italics*).

Grading Factors Line

On the grading factors line, simply write the percentage of the factor that makes the sample a particular grade within the box of that factor. Always record the moisture and test weight for all samples. If the grade is U.S. No. 1, leave the grading factors line blank except for test weight and moisture. See example below. Be careful not to confuse the box with "Broken Corn and Foreign Material" (used for corn only) with "Foreign Material" (used for soybeans and wheat only).

GRADE AND KIND <i>U.S. No. 1, 2, 3, 4, 5, or Sample Grade, Class, Special Grade(s).</i>								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<i>53.0</i> LBS.	<i>15.6</i> %	%	<i>5.1</i> %	%	%	%	%	%

Sample #1

REMARKS

Factors which do not affect the grade may be correctly reported. Some customers may request that additional information be reported. However additional information must be correct or it will be treated as an incorrect grading factor and scored appropriately.

How is grain grading scored and what do I need?

- A table of grain grading requirements (green sheet) will be provided to each participant for all grain grading problems. *Junior Participants will have a copy of the "Grain Grading Handbook" section of this booklet.*
- Each participant will grade four samples of corn, two samples of soybeans, and two samples of soft red winter wheat.
- A list of percentages and weights will be given for each sample to be graded. The cut of the grain sample that the percentage was found in will not be reported. Therefore one should assume that the percentage or weight listed came from the separation of that particular determination. The participant will NOT be required to pick a sample and additional equipment is not used.
- The Official Grain Standards of the United States, published by the U.S. Department of Agriculture, Federal Grain Inspection Service, will be the official manual for completing the answer sheet which resembles an official grain grading certificate. If however, the rules of

grading change during the five year coverage of this document, the rules spelled out within this document will have precedence.

- The sample will be scored on the basis of the grade line, grading factors line, and remarks section (negative scores for any line will be scored as zero points).

	<u>Points</u>
Correct grade line	10 total
<u>Grade:</u>	
Corn and Soybeans	
<u>Correct grade</u>	6 points
Incorrect by one grade	2 points off
Incorrect by two grades	4 points off
Incorrect by three or more grades	6 points off
Correct class	4 points
Special Factors	3 points
Wheat:	
<u>Correct grade</u>	6 points
Incorrect by one grade	2 points off
Incorrect by two grades	4 points off
Incorrect by three grades or more	6 points off
Correct class (Soft Red Winter Wheat)	1 point
Special Factors	3 points
Dockage correctly recorded	3 points

	<u>Points</u>
Correct factor boxes	12 total
<u>Scoring of Grading Factor Line Boxes:</u>	
Corn, Soybeans and Wheat:	
All correct	12 points
2 factors with 1 correct	6 points off
3 factors with 2 correct	4 points off
3 factors with 1 correct	8 points off
4 factors with 3 correct	3 points off
4 factors with 2 correct	6 points off
4 factors with 1 correct	9 points off
No factors correct	12 points off

- The test weight and moisture boxes should always have the correct weight and percentage recorded and are always considered factors. Grain moisture never has a direct effect upon the grade of a grain sample.

	<u>Points</u>
Correct remarks box	3 total

The three points will be divided by the number of remarks that are needed in this box.

- Some customers request that information in addition to grading factors be recorded on the grain certificate. If extra information (other than factors which affect grade) is recorded on the answer sheet, the information must be correct. If the additional information is not correct then a point is deducted for each incorrect factor box (second line). For example, if a participant incorrectly records Damaged Kernels (Total) information and that information is not a grading factor, the contestant would lose 1 of their 12 points possible for that line. Negative line scores should be recorded as 0 points.
- One point will be deducted for each grade line incorrectly written (i.e., order, spelling, or capitalization). See examples of correctly written grades.
- In cases of numbers less than 1, such as **.7**, the number written in the factors box should include a zero before the decimal. If it is not written as **0.7**, the answer will be counted wrong. Example: **Broken Corn and Foreign Material 0.7%**
- Extraneous marks, such as 0's or dashes, put in factor boxes will be counted as wrong answers. The answer sheet is considered the same as an official document and should not be marked with extra unneeded marks..
- A maximum of 25 points will be given for each sample. If a participant gets a tabulated negative score for any one of the three lines , he/she will receive zero points for that line. Therefore no one can receive negative points on any problem.

Official Grain Grading Answer Sheet

GRADE AND KIND								
U.S. No.								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #1

REMARKS

GRADE AND KIND								
U.S. No.								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #2

REMARKS

GRADE AND KIND								
U.S. No.								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #3

REMARKS

GRADE AND KIND								
U.S. No.								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #4

REMARKS

GRADE AND KIND
U.S. No.

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #5

REMARKS

GRADE AND KIND
U.S. No.

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #6

REMARKS

GRADE AND KIND
U.S. No.

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #7

REMARKS

GRADE AND KIND
U.S. No.

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
LBS.	%	%	%	%	%	%	%	%

Sample #8

REMARKS

SAMPLE GRAIN GRADING PROBLEMS

Sample 1:

Soft Red Winter Wheat	96.5%
Hard Red Spring Wheat	2.0%
Durum Wheat	1.5%
Moisture	13.5%
Damaged Kernels (Total)	1.0%
Foreign matter (g/250g)	1.25g
Test Weight (lb/bu)	60.3
Dockage (g/1000g)	26
Natural odor	

Sample 5:

Soft Red Winter Wheat	100.0%
Heat damage	0.6%
Sprout damage	2.0%
Insect damage	1.4%
Damage by heat (Slight)	3.0%
Foreign material (g/125)	0.75g
Shrunken & broken kernels	0.5%
Test Weight (lb/bu)	62.0
Moisture	14.8%
Dockage (g/1000g)	10
Natural Odor	

Sample 2:

Yellow Soybeans	99.0%
Green Soybeans	1.0%
Corn	3.0%
Foreign material thru sieve	2.1%
Damage by heat (Slight)	2.0%
Heat damage (Severe)	1.9%
Green garlic bulblets in 1000 g	6
Test weight (lb/bu)	48.0
Moisture	21.34%
Natural odor	

Sample 6:

Yellow Corn	100.0%
Moisture	14.0%
Corn cobs on top of sieve	1.1%
Giant foxtail	0.9%
Sprout damage	1.0%
Test weight (lb/bu)	58.04
Natural odor	

Sample 3:

White Corn	5.0%
Yellow Corn	95.0%
White popcorn	2.0%
Moisture	11.2%
Insect damage	2.0%
Mold damage	1.1%
Broken corn thru sieve	2.6%
Live weevils per 1000 g	3
Test weight (lb/bu)	55.0
Natural odor	

Sample 7:

Yellow Soybeans	89.0%
Bi-colored Soybeans	11.0%
Sprout damage	1.3%
Frost damage	0.7%
Damage by heat (Slight)	4.0%
Foreign material	3.0%
Moisture	16.0%
Dry garlic bulblets per 1000 g	3
Test weight (lb/bu)	56.0
Natural odor	

Sample 4:

Yellow Flint Corn	95.0%
White Corn (Dent)	5.0%
Moisture	16.0%
Broken corn through sieve	8.0%
Heat damage (Severe)	2.9%
Slight damage by heat	0.3%
Crotalaria - 3 in 1000 g	
Test weight (lb/bu)	57.9
Sour	

Sample 8:

White Corn	100.0%
Moisture	19.0%
Yellow Sweet Corn	5.0%
Mold damage	2.9%
Sprout damage	4.4%
16 live Angoumois moths in the lot	
Test weight (lb/bu)	57.3
Natural odor	

Grain Grading Answer Sheet

Sample Problem Answers

GRADE AND KIND								
U.S. No. 2 Soft Red Winter Wheat, Dockage 2.6%								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>60.3</u> LBS.	<u>13.5</u> %	%	1.0 %	0.5 %	%	%	%	1.5 %

Sample #1	REMARKS <p style="text-align: center;"><u>Contrasting Classes 1.5%</u> <u>Wheat of Other Classes (Total) 3.5%</u></p>
-----------	--

GRADE AND KIND								
U.S. No. Sample Grade Yellow Soybeans, Garlicky								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>48.0</u> LBS.	<u>21.3</u> %	1.9 %	3.9 %	<u>5.1</u> %	%	%	%	%

Sample #2	REMARKS <p style="text-align: center;">Soybeans of Others Colors 1.0%</p>
-----------	--

GRADE AND KIND								
U.S. No. 4 Yellow Corn, Infested								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>55.0</u> LBS.	<u>11.2</u> %	%	3.1 %	%	%	<u>4.6</u> %	%	%

Sample #3	REMARKS
-----------	---------

GRADE AND KIND								
U.S. No. Sample Grade Yellow Corn, Flint								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>57.9</u> LBS.	<u>16.0</u> %	2.9 %	3.2 %	%	%	<u>8.0</u> %	%	%

Sample #4	REMARKS <p style="text-align: center;"><u>Sour</u> <u>Crotalaria</u></p>
-----------	---

All things listed in bold are required. Things listed without bold or underline are only counted wrong if not reported exactly as written. They are not counted wrong if absent.

GRADE AND KIND
U.S. No. 4 Soft Red Winter Wheat, Dockage 1.0%

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>62.0</u> LBS.	<u>14.8</u> %	0.6 %	7.0 %	0.6 %	%	%	0.5 %	<u>8.1</u> %

Sample #5

REMARKS

GRADE AND KIND
U.S. No. 1 Yellow Corn

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>58.0</u> LBS.	<u>14.0</u> %	%	1.0 %	%	%	2.0 %	%	%

Sample #6

REMARKS

GRADE AND KIND
U.S. No. 4 Mixed Soybeans

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>56.0</u> LBS.	<u>16.0</u> %	%	<u>6.0</u> %	3.0 %	%	%	%	%

Sample #7

REMARKS
Yellow Soybeans 89.0%
Bi-colored Soybeans 11.0%

GRADE AND KIND
U.S. No. 4 White Corn, Infested

TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
<u>57.3</u> LBS.	<u>19.0</u> %	%	<u>7.3</u> %	%	%	<u>5.0</u> %	%	%

Sample #8

REMARKS

Grain Grading Answer Sheet

Sample Problem Graded Example

The grade line would be counted 2 off because of the grade being one grade off								
GRADE AND KIND								
U.S. No. 3 Soft Red Winter Wheat, Dockage 2.6%								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
60.3 LBS.	13.5 %	%	%	1.3 %	%	%	%	%

Sample #1	The Factor line would only have a minus one for the foreign material being wrong.	REMARKS
Score 19/25		The remarks box would be minus 3 because it lacks the Contrasting Classes and Wheat of Other Classes (Total).

The grade line would be counted 4: 3 off because of the lack of the special grade Garlicky and one off for not crossing out the No.								
GRADE AND KIND								
U.S. No. Sample Grade Yellow Soybeans								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
48.0 LBS.	21.4 %	3.9 %	%	5.1 %	%	%	%	%

Sample #2	The Factor line would be a minus 5: One for the Heat damage being wrong and 4 for the wrong moisture.	REMARKS
Score 16/25		The remarks box would not have any counted off.

The grade line would be counted 8 off: 4 because of the grade being two grades off and 4 because of the incorrect corn class.								
GRADE AND KIND								
U.S. No. 2 Mixed Corn, Infested								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
55.0 LBS.	11.2 %	%	3.1 %	%	%	2.6 %	%	%

Sample #3	The Factor line would be a minus 4 because the Broken Corn & Foreign Material box is wrong.	REMARKS
Score 10/25		Yellow Corn 93.0% White Corn 7.0%
		The remarks box would have a minus 3 for having anything in the box .

The grade line would not have any counted off .								
GRADE AND KIND								
U.S. No. Sample Grade Yellow Corn, Flint								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
57.9 LBS.	16.0 %	3.1 %	%	%	%	8.0 %	%	%

Sample #4

Score
22/25

The Factor line would be a minus 1 for having the wrong Heat Damage percent.

REMARKS

sour
crotalaria

The remarks box would be minus two: one for lack of capitalization on both and one for misspelling Crotalaria.

The remarks box would be minus two: one for lack of capitalization on both and one for misspelling Crotalaria.

The grade line would be counted 1 off because of the incorrect Dockage percent

GRADE AND KIND								
U.S. No. 4 Soft Red Winter Wheat, Dockage 10%								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
62.0 LBS.	14.8 %	0.6 %	7.0 %	0.8 %	%	%	0.5 %	8.3 %

Sample #5

Score 19/25

The Factor line would be a minus 5: 4 for the incorrect Defects(Total) and 1 for having the wrong Foreign Material

REMARKS

The remarks box would not have any counted off.

The grade line would have no points counted off.

GRADE AND KIND								
U.S. No. 1 Yellow Corn								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
58.4 LBS.	14.0 %	%	%	%	%	%	%	%

Sample #6

Score 19/25

The Factor line would be a minus 6 for having the wrong Test Weight.

REMARKS

The remarks box would not have any counted off.

The grade line would be counted 2 off for being one grade off.

GRADE AND KIND								
U.S. No. Sample Grade Mixed Soybeans								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
56.0 LBS.	16.0 %	4.0 %	%	%	%	%	%	%

Sample #7

Score 15/25

The Factor line would be a minus 5: 1 for having the wrong Heat Damage percent and 4 for not including Damaged Kernels (Total).

REMARKS

The remarks box would be minus 3 for missing information on Mixed Soybeans.

The grade line would be minus 3 for missing the Infested special grade.

GRADE AND KIND								
U.S. No. 4 White Corn								
TEST WEIGHT PER BUSHEL	MOISTURE	HEAT-DAMAGED KERNELS	DAMAGED KERNELS (TOTAL)	FOREIGN MATERIAL	SPLITS	BROKEN CORN AND FOREIGN MATERIAL	SHRUNKEN AND BROKEN KERNELS	DEFECTS (TOTAL)
57.3 LBS.	19.0 %	%	7.3 %	5.0 %	%	%	%	%

Sample #8

Score 18/25

The Factor line would be a minus 4: One for having something in the Foreign Material box and 3 for missing percent in Broken Corn and Foreign Material.

REMARKS

The remarks box would not have any counted off.

Section III - AGRONOMY EXAM

- The test questions will test the general agronomic knowledge of the participant. The suggested references and objectives follow that will be helpful in preparing for this section of the event.
- The questions will be multiple choice to facilitate grading.
- ID 179 Corn & Soybean Field Guide may be used by participants while taking the exam. The most recent year will always be the reference used.

Exam Objectives

To successfully complete the portion of the multiple choice exam pertaining to corn production, soybean production, and general agronomic knowledge; the participant will be able to:

1. Assess fertility needs and make nutrient recommendations for corn and soybeans using tables.
2. Calculate fertilizer needs and costs to satisfy a specific nutrient requirement.
3. Diagnose fertility, pest, compaction, and disease problems related to specific field situations.
4. Calculate insecticide and herbicide needs for a specific field situation.
5. Calculate area, length and volume measurements related to agriculture.
6. Explain how crop residue is measured by the Natural Resources Conservation Service (NRCS) and why crop residue is measured after planting.
7. Recognize methods to achieve crop residue percentages required to meet conservation compliance on highly erodible land for corn & soybeans rotations.
8. Identify the herbicide mode of action group most likely responsible for specific herbicide injury symptoms.
9. State a procedure for diagnosing crop production problems in a field.
10. Recommend nozzle tips that would be best suited for spraying in a specific field situation.
11. Determine the growth stage of a corn or soybean plant.
12. Define a soybean relative maturity group and predict what would happen if a variety is planted outside its recommended maturity range (e.g. move group II to southern Indiana).
13. Explain the effect and use of temperature developmental units for agriculture.
14. Use current weather information to calculate growing degree days.
15. Consult tables and charts to obtain information from reference materials.

16. Use corn and soybean moisture conversions to calculate actual pounds per bushel.
17. Define the cation exchange capacity of a soil and state the two factors that influence the cation exchange capacity of a soil.
18. Complete the process necessary to submit plant, soil or insect samples to a lab in order to reduce sampling error (often the largest source of error).
19. Contrast features of conventional versus reduced tillage systems related to temperature, moisture, and soil erosion.
20. Describe what the user of any herbicide should find on a label of the product.

To successfully complete the portion of the multiple choice test pertaining to wheat, the participant will be able to:

1. List varietal characteristics important in wheat variety selection.
2. Schedule a nitrogen fertility program for optimum wheat production.
3. Use tables and soil test information to determine nitrogen, phosphorous, and potassium needs.
4. Schedule a fertility program for double-cropping no-till soybeans following wheat.
5. State factors that affect the planting date of wheat.
6. List conditions when it is appropriate to plant seed from your own bin.
7. Suggest the proper seeding depth and soil conditions for ideal wheat growth.
8. State the typical seeding rate and plant population of soft red winter wheat.
9. State two conditions that lead to lodging (falling over) of wheat.

To successfully complete the portion of the multiple choice test related to forages, the participant will be able to:

1. List 3 reasons a pure stand is advantageous over a mixed stand.
2. List 5 reasons a mixture is advantageous over a pure stand.
3. Contrast the suitability of Alfalfa, Timothy, Smooth brome grass, and Orchardgrass to a 3 vs. 4 cutting system.
4. Contrast the suitability of Alsike clover, Red clover, Alfalfa, Reed canarygrass, Tall fescue, Orchardgrass, and Smooth brome grass to various levels of soil drainage and fertility.
5. State the benefits of legume-renovated pastures.
6. Describe the common problems encountered when renovating pastures.
7. State the steps required to achieve successful pasture renovation.

8. Describe the effect of improper liming, phosphorous and potassium fertilization in Alfalfa.
9. Determine factors that lead to heaving of tap rooted plants such as Alfalfa.
10. Identify alfalfa weevil, potato leaf hopper, grass hoppers, anthracnose, phytophthora root rot, fusarium wilt and bacterial wilt.

In order to complete the portion of the multiple choice test pertaining to plant physiology, the participant will be able to:

1. Differentiate the three (3) major components: pericarp, endosperm, and embryo in a grass caryopsis (grain kernel).
2. Distinguish between hypogeal and epigeal emergence.
3. Determine differences in root systems, stems, and leaf structures between dicot and monocot plants.
4. Compare and contrast specialized stems such as rhizomes, tubers, stolons, corms, bulbs, culms and stalks in growth location and physical appearance.
5. Label a diagram of the external features of a Red clover, Alfalfa, and grass leaf.
6. Label the parts of a basic flower, a legume flower, and a grass flower.
7. Differentiate among the spike, raceme, panicle, and head types of inflorescence.

In order to complete the portion of the multiple choice test related to grain grading, the participant will be able to:

1. State the top 3 grain crops and their quantity that Indiana contributes to the market place.
2. Recognize the usual grade of market quotes and where market quotes may be obtained.
3. List the grains for which standards have been established.
4. Explain procedures used in determining grades for corn, soybeans and wheat.

REFERENCE MATERIALS FOR CROP EVENTS

1. Corn Kernel Damage #216, Soybean Kernel Damage #215, and Wheat Kernel Damage #213. These three publications detail disease and damage with pictures and descriptions.

Contact: Kim Anderson, Extension Agriculture Economics, Oklahoma State University
(405) 744-6082

Cost: \$0.75 each

2. Corn & Soybean Field Guide ID-179

Contact: Ag Communication
Media Distribution Center
Purdue University
231 South University Street
Lafayette, IN 47905
phone: 1-888-EXT-INFO

<https://secure.agriculture.purdue.edu/store/>

Cost: \$6.00 (#2)

- #3-6 The following are all available as web only publications from on or both of the following sites:

<http://www.agry.purdue.edu/ext/pubs.html>

3. Wheat Production and Fertilization in Indiana AY-244-W

4. Forage Selection and Seeding Guide for Indiana AY-253-W

5. Improving Pastures by Renovation: http://www.agry.purdue.edu/ext/forages/pubs_toc.htm

6. Estimating Crop Residue Cover AY-269-W

Online at: <http://www.ces.purdue.edu/extmedia/agronomy.htm>

7. Alfalfa Analyst

Contact: Currently out of print, new edition being written

Cost: TBA

8. Color Picture Sheets

Assorted Crop Disease Symptoms

Assorted Herbicide Injuries

Crop and Weed ID

Illinois Vocational Agriculture Service

University of Illinois

College of Agriculture

1401 S. Maryland Dr.

Urbana, IL 61801

(217) 333-3871

References used for the creation of this booklet entitled: "Agronomy Skills Development"

Hood, E.L., Ohm H., and N. Reynolds. Crops Judging in Indiana, 4H-446. 1989.
(out of print).

United States Department of Agriculture, Federal Grain Inspection Service. The Official Grain Standards of the United States.

Purdue University Ag Statistics Service.

The "Agronomy Skills Development" is dedicated to **Dr. Eldon Hood** for the many years that he faithfully coordinated and staged 4-H and FFA Crop Events in Indiana.