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Examining and Grading Grains



Examining and Grading Grains

BY

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WHEAT

CLASSIFICATION OF SPECIES AND VARIETIES.

The wheats are classified into several species and varieties, founded on distinct differences.

Wheat belongs to the family of plants known as the Gramineae which includes all of our cereal crops and meadow grasses.

All of these plants are readily distinguished by having only one seed leaf and are technically known as monocotyledons.

Wheats seem to be most properly classified into species and races, as follows:

Triticum monococcum (one grained wheat), spikes compact, spikelets 3 flowered but 1 grained, bearded. Very old, belongs to Stone age, grown in Spain, Germany, Switzerland. Not much of a bread wheat.

Triticum Polonicum (Polish wheat), large, open heads, spikelets 2 to 3 seeded, bearded. Seeds long, bright and glossy. Cultivated in parts of Eastern Europe and Northern Africa.

Triticum sativum, divided into races, as follows:

Tr. sat. vulgare (common wheat), 4 flowered spikelets, 3 grained, both bearded and beardless. Our common bread wheats, many varieties, almost exclusively grown in this country.

Tr. sat. compactum ("Hedgehog wheat," "Dwarf wheat"), spikes short, dense, distinctly 4 sided, both bearded and beardless. Grown in Switzerland and neighboring region, also in Turkestan and Chili.

Tr. sat. turgidum ("English wheat," "Egyptian wheat"), spikes large, dense, 4 sided, 2 to 3 seeded,

bearded. Largely grown in Mediterranean countries, also in Egypt, England and Germany.

Tr. sat. durum (True bearded, or Hard wheats), spikelets 3 to 4 seeded, long stiff awns; seeds large, bright and glossy. This race comprises the so-called Macaroni wheats which are at present being extensively tested in the semi-arid portions of the country. They are widely grown in Eastern Europe and Northern Africa.

Tr. sat. Spelta (Spelt), spikes long and very loose, darkish colored when ripe, spikelets 3 seeded at base, 2 at top of spike. Chaff adheres to grain. Little grown in this country. At home in the mountain regions of Europe and Asia.

Tr. sat. dicoccum (Emmer), spikelets 2 seeded, rather compactly arranged in 2 rows, generally dark colored, grain very hard, enclosed in chaff. Little grown in this country. More common in Central Europe.

The varieties of *Triticum durum*, commonly known as "Macaroni wheats" because of the excellent quality for the manufacture of macaroni and similar pastes, are considered very hardy and drought-resistant and give promise of becoming valuable wheats for the semi-arid regions of this country.

Emmer (*T. dicoccum*), commonly confused with spelt, also gives promise of a wider usefulness.

Of these wheats we are principally concerned with the varieties of *Triticum Sativum vulgare*.

LABORATORY STUDY OF CHARACTERS.

In the study of wheats in the head, specimens of several varieties should be examined, including specimens of the four principal types of wheat, viz., *Triticum vulgare*; *T. durum*; *T. spelta*, and *T. Polonicum*.

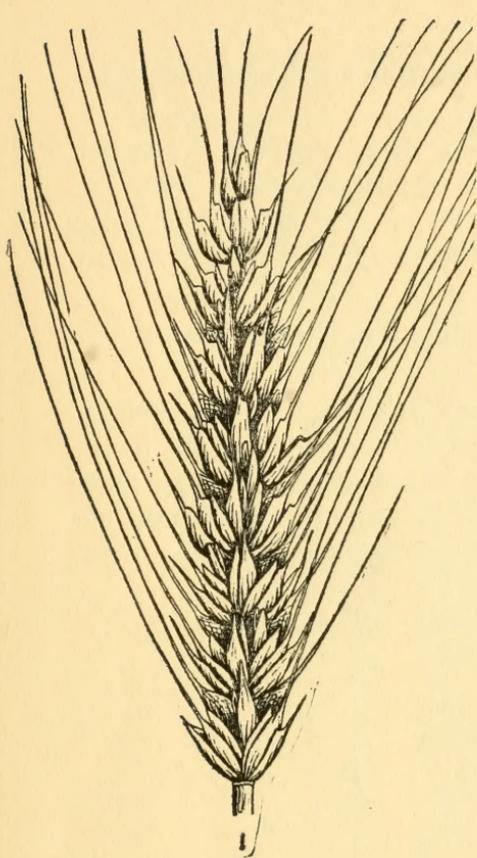
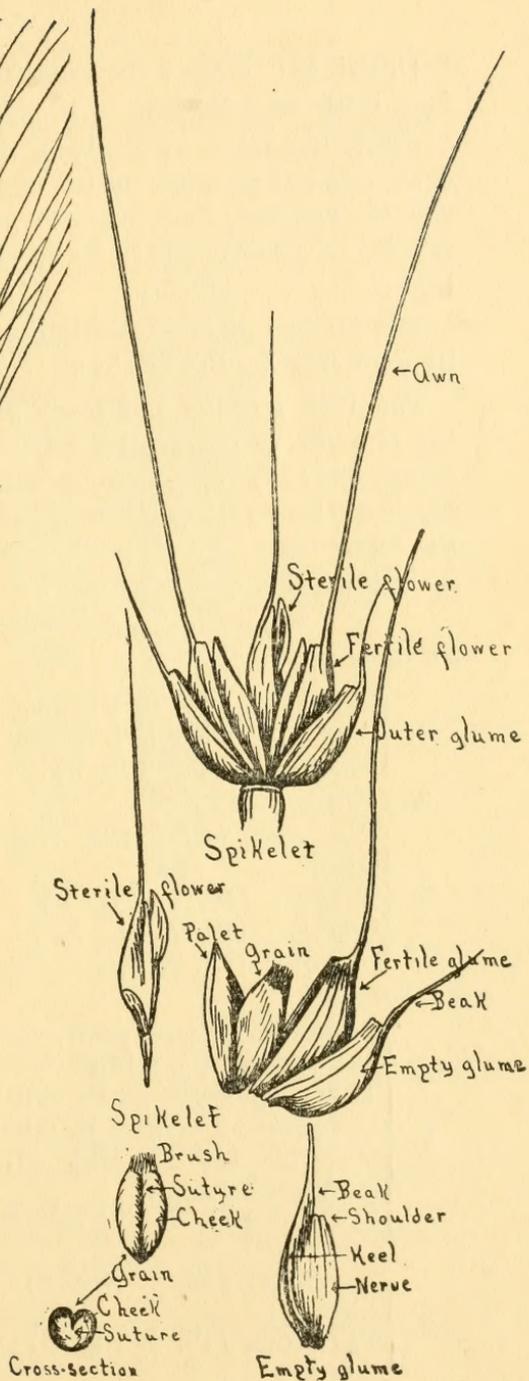


PLATE 1

The above cut shows a spike of ordinary wheat. On the right a single spikelet is first shown. Below this the spikelet is torn into its several parts and each part named.



Drawings: Make a drawing from a spike of each of the four types as follows:

First, the spike as a whole, then removing a spikelet, draw this entire, showing the embriicated view. Then dissect the spikelet, drawing each part out separately, being careful to arrange the parts in their proper relative position.

The method of cross-fertilizing wheats may now be easily explained by the teacher.

The Wheat Spike and Descriptive Terms. The following is a list of descriptive adjectives which apply to the wheat head. The student is supplied with two or three heads of the wheat to be described, and proceeds to fill out the blank used in describing wheats, using the list of descriptive terms as a reference:

TERMS FOR DESCRIBING CHARACTERS

SPIKE

- | | | | | |
|----|---|--------------------------------|---|---|
| 1. | { | Beardless (Pl. 2, Fig. 3) | } | |
| | { | Partly bearded (Pl. 2, Fig. 4) | } | |
| | { | Bearded (Pl. 2, Fig. 2) | } | |
| 2. | | Length, inches | | |
| 3. | { | Very open (Pl. 2, Fig. 3) | } | } Refers to how closely the spikelets are set together. |
| | { | Open | } | |
| | { | Medium (Pl. 1, Fig. 1) | } | |
| | { | Compact (Pl. 2, Fig. 1) | } | |
| | { | Crowded (Pl. 2, Fig. 4, tip) | } | |

Shape

- | | | | |
|----|---|---|---|
| 1. | { | Tapering toward apex, Heads which taper gradually from the middle toward the tip. | } |
| | { | Tapering both ways, Heads which are spindle shaped or largest in middle. | } |
| | { | Uniform (Pl. 2, Fig. 1), Heads same diameter throughout. | } |
| | { | Clubbed (Pl. 2, Fig. 4), Heads larger at tip than below. | } |
| 2. | { | Tip acute (Pl. 2, Fig. 2), Tip spikelets not developed. | } |
| | { | Tip blunt (Pl. 2, Fig. 4), Tip spikelets well filled out. | } |

3. { Base abrupt (Pl. 2, Fig. 2), Basal spikelets well developed.
 { Base tapering, Basal spikelets not well developed.

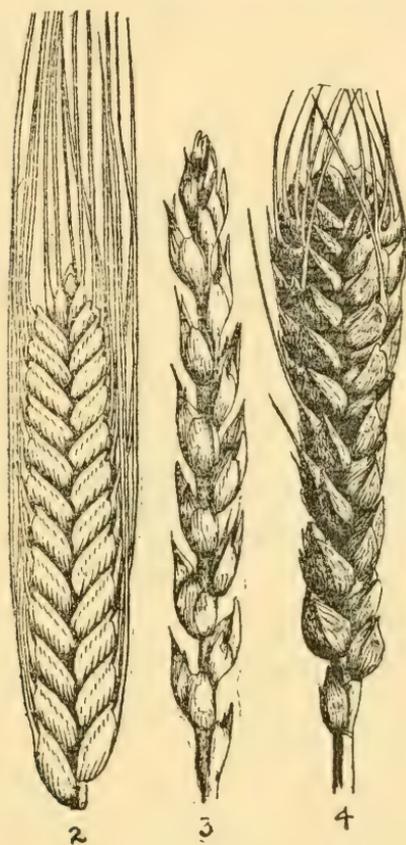


PLATE 2

Three types of wheat heads. No. 2, macaroni wheat; No. 3, a common type of bald wheat; No. 4, club wheat.

- { Square. Refers to cross-section.
4. { Flattened with spikelets (Pl. 1, Fig. 1). Diameter of head through spikelets least.
 { Flattened across spikelets (Pl. 2, Fig. 2), Diameter through spikelets greatest.
5. { Sterile spikelets, 1, 2, 3, 4. Sterile spikelets at tip and base of spike.

Color

- { Whitish
- { Yellow
- { Yellowish brown
- 1. { Rosy
- { Red
- { Bluish
- { Brown
- { Black

AWNS

- { Long, 4 in. or more in length.
- 1. { Medium, 2 in. to 4 in. in length.
- { Short, 2 in. or less in length.

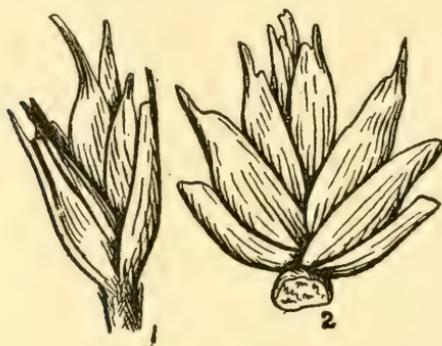


PLATE 3

Two types of wheat spikelets.

- 2. { Parallel (Pl. 2, Fig. 2)
- { Spreading
- { Spreading widely (Pl. 1, Fig. 1) } Has reference to the relative position of awns and spike.
- 3. { Deciduous. Awns falling as soon as grain is mature.
- { Partly deciduous }
- { Persistent. Awns not falling off naturally.

Color

- { Whitish
- 1. { Brownish
- { Yellow Black

SPIKELET

- 1. { Spreading widely (Pl. 3, Fig. 2)
- { Spreading
- { Narrow (Pl. 3, Fig. 1) } Refers to the relative width of the spikelet.
- 2. Number of grains, 1, 2, 3, 4, 5, 6, 7.

Outer glume

1. { Hairy (Pl. 5, Figs. 2 and 3)
Partly hairy
Smooth (Pl. 5, Figs. 1 and 4)
2. { Glossy
Medium
Dull
3. { Uniform in color
Streaked

Size

1. { Broad (Pl. 4, Fig. 2)
Medium
Narrow (Pl. 4, Fig. 1)
- Refers to the general shape of of the glume, and the way it fits about the grain.

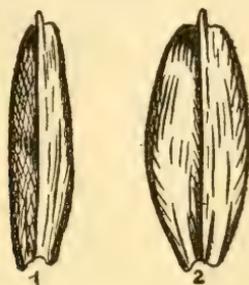


PLATE 4

Wide and narrow outer glumes

2. { Short
Long
- In comparison with rest of spikelet.

Attachment

1. { Firm
Weak

Keel

1. { Broad
Medium
Narrow
- The keel is the central nerve, most prominent in varieties of *T. Durum*.

Beak

1. { Long (Pl. 5, Fig. 3)
Medium
Short (Pl. 5, Fig. 1)
 2. { Acute (Pl. 5, Fig. 3)
Blunt (Pl. 5, Fig. 2)
- The beak is the extended midrib of the empty glume, which, on the flowering glume when more extended, is called an awn.

Shoulder

1. { Broad (Pl. 5, Fig. 3)
Narrow (Pl. 5, Fig. 1)
2. { Square (Pl. 5, Fig. 3)
Sloping (Pl. 5, Fig. 1)
Round (Pl. 5, Fig. 2)

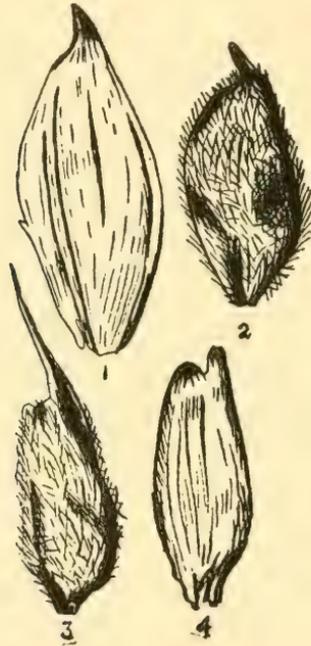


PLATE 5

Types of outer glumes, showing typical beaks and shoulders.

GRAIN

1. { Very hard
Hard
Medium
Soft
Very soft }

This point is determined by biting or cutting open several grains and comparing with standard samples.

Size

Wt. 100 av. seeds, grams.....

Shape

- 1. { Long (Pl. 6, Fig. 3)
 { Medium
 { Short (Pl. 6, Fig. 2)
 { Curved (Pl. 6, Fig. 1)
 { Straight
 { Pear-shaped (Pl. 6, Fig. 5)
- 2. { Thin
 { Medium
 { Plump
- 3. { Flat-cheeked (Pl. 6, Fig. 7)
 { Plump-cheeked (Pl. 6, Fig. 8)
 { Angular-cheeked (Pl. 6, Fig. 9)
- 4. { Pointed at tip
 { Blunt at tip
- 5. { Pointed at base
 { Blunt at base

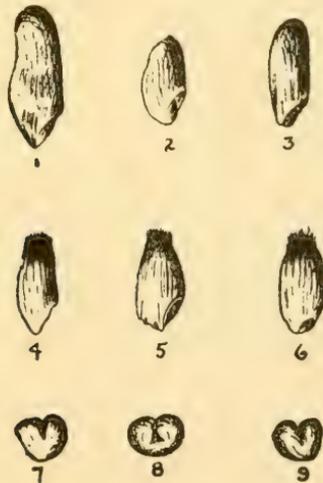


PLATE 6

Types of wheat grains and cross sections.

Color

1. { Whitish
Yellowish
Clear amber
Dull amber
Clear red
Dull red

Crease

1. { Deep
Medium (Make cross section and compare.)
Shallow
2. { Wide
Medium
Narrow

Cross-section

1. { Very horny } Refers to appearance. When the grain in
Horny } cross-section is hard and vitreous in texture,
Dull } it is "very horny," but when there is no
Starchy } horny portion, but the cross-section is all
white and starchy in appearance, it is called
"starchy,"

GENERAL CHARACTERISTICS

1. { Hardy }
Delicate }
 2. { Early }
Medium }
Late }
 3. Days maturing
 4. { Autumn-planted }
Spring-planted }
- These points can only be determined by referring to field notes on the variety.

OUTLINE FOR DESCRIBING WHEAT

Variety Name Number of Sample....

SPIKE

1

2

3

Shape

1

2

3

4

5

Color

1

AWNS

1

2

3

Color

1

SPIKELET

1

2

Outer Glume

1

2

3

Size

1

2

Attachment

1

Keel

1

Beak

1

2

Shoulder

1

2

GRAIN

1

Shape

1

2

3

4

5

Color

1

Crease

1

2

Cross-section

1

GENERAL CHARACTER-
ISTICS

1

2

3

4

Student's Name Date.....

EXAMINING AND GRADING WHEATS.

The object of this work is not primarily to learn what constitutes a grade, but rather to give the student a knowledge, based on critical examination, of the qualities and characteristics of the common varieties and grades of wheat, both good and bad.

For this purpose, have in hand a copy of the following: "Points to be Observed in Judging Wheat" together with the "Inspection Rules."

About 25 samples are provided as before, each to be graded and examined carefully as to "Hardness", "Texture", "Weight", "Color", etc., as described in "Points to be Observed." As this course is concurrent with a course of lectures on field crops, the significance of these points should be understood.

POINTS TO BE OBSERVED

Hardness. The hardness of wheat varies greatly in different sections of the country. This is due to the definite effect of environment. Wheats grown in a region of abundant rainfall and under humid conditions, are usually softer and lighter colored and lower in protein content than wheats grown under dryer conditions.

Winter wheats grown in most of the states east of the Mississippi river are of the softer type and known as "red" winter wheats, while those grown in the belt of country bordering on the semi-arid and running through Nebraska, Kansas, and Oklahoma, are generally of the hard, dark red type and known as "hard" winter wheats.

The hard winter wheats are mostly of the Turkish Red variety. The characteristics however which mark it as a hard winter wheat, are due to environment, since this same variety if grown in Illinois for example, soon loses its hard qualities and grades instead as a "red" winter wheat.

The same is also true of spring wheats, the famous "No.

1 Hard Spring" coming from the somewhat dry climate of the Dakotas, Minnesota, and the Northwest.

Northern wheats are generally somewhat harder than southern, though this quality seems to depend on soil and climatic conditions more than on latitude.

Texture. Texture and hardness are closely correlated. The texture is examined by making cross sections of the grain and is described as horny, when it is found to be dark and vitreous in appearance, with no starch showing. Opposed to these are the grains which are white and starchy throughout. This is the characteristic appearance of the soft white wheats of the Pacific coast and Australia, while the horny texture is characteristic of the macaroni, all hard winter and spring wheats. Wheats of a horny texture are generally higher in protein content, and produce a stronger flour.

Weight. The weight per measured bushel has always been regarded as of the greatest importance in judging the quality of wheat. In a general way, it is true that a good wheat never has a low weight per bushel, while a poor wheat is never high in weight.

Light weight may be due to immaturity, to premature dry weather or hot winds, or the attacks of insects. The skin is wrinkled and not well filled out with starch. The weight of good wheat may be reduced by exposure to inclement weather when part of the grain is sprouted or is swelled and soaked by water until it never quite regains its normal size, or is overheated in the stack, called stack burning, or piled up in bins when too damp, causing heat and mould.

Soundness. A good No. 1 wheat should have no sprouted, decayed or injured grains from any cause, as exposure, stack burning, or moths. A No. 2 wheat might have a few discolored grains, but none sprouted. A No. 3 wheat if dry and in good condition otherwise, might contain a few sprouted grains. However, the number of

injured grains which may pass in a grade, depends largely on how good the wheat was before suffering injury, the present dryness, etc., of the sample. Grading is always based as near as possible on the actual milling quality of the grain.

Mustiness. This is caused usually by dampness, either while the grain is in stack or bin. Musty wheat is almost worthless for flour, since the grain is permeated with a musty flavor. For this reason, even a slight trace of must is always discriminated against, even though the wheat may still be used for low grade flour. Musty grain is often worked into chop or some form of stock food.

Color. Wheat ranges in color from nearly a brick red, through various shades of brown to almost white. In a general way, wheats from mild and humid climates are light colored, while those of colder and dry climates are dark. Some have a smooth, bright appearance, while in others the color is dull. Good wheat should not be bleached or in any way discolored, but generally bright and in the hard wheats have a vitreous appearance. The occurrence of "yellow berries" in hard wheats, greatly depreciates its value as they give a yellow color to the flour.

"Stack burning" gives wheat a dark and somewhat burnt appearance; exposure to weather, a bleached and dull appearance, while overheating in the bin, usually a whitish appearance and musty smell.

WHEAT INSPECTION RULES*

No. 1 Red Winter Wheat shall be pure Red Winter Wheat of both light and dark colors of the shorter berried varieties, sound, plump, and well cleaned.

No. 2 Red Winter Wheat shall be Red Winter Wheat of both light and dark colors, sound and reasonably clean.

No. 3 Red Winter Wheat shall include Red Winter Wheat not clean and plump enough for No. 2, but weighing not less than fifty-four pounds to the measured bushel.

*Rules adopted by the Board of Railroad and Warehouse Commissioners for the inspection of grain at Chicago.

No. 4 Red Winter Wheat shall include Red Winter Wheat, damp, musty, or from any cause so badly damaged as to render it unfit for No. 3.

Red Winter Wheat containing a mixture not exceeding five per cent of White Winter Wheat shall be classed as Red Winter Wheat.

Red Winter Wheat containing more than five per cent of White Winter Wheat shall be graded according to the quality thereof and classed as White Winter Wheat.

Hard Winter Wheat. The grades of Nos. 1, 2, 3 and 4 Hard Winter Wheat shall correspond in all respects with the grades of Nos. 1, 2, 3 and 4 Red Winter Wheat, except that they shall be of the Turkish variety.

In case of mixture of Turkish Red Winter Wheat with Red Winter Wheat, it shall be graded according to the quality thereof, and classed as Hard Winter Wheat.

Spring Wheat.

No. 1 Northern Spring Wheat must be Northern grown Spring Wheat, sound and reasonably clean and of good milling quality and must contain not less than 50 per cent of the hard varieties of Spring Wheat.

No. 2 Northern Spring Wheat must be Northern grown Spring Wheat, not clean enough or sound enough for No. 1, and must contain not less than 50 per cent of the hard varieties of Spring Wheat.

No. 1 Spring Wheat shall be sound, plump, and well cleaned.

No. 2 Spring Wheat shall be sound, reasonably clean, and of good milling quality.

No. 3 Spring Wheat shall include all inferior, shrunken, or dirty Spring Wheat, weighing not less than fifty-three pounds to the measured bushel.

No. 4 Spring Wheat shall include Spring Wheat, damp, musty, sprouted, badly bleached, or for any cause which renders it unfit for No. 3.

White Spring Wheat. The grades of Nos. 1, 2, 3 and 4

White Spring Wheat shall correspond with the grades of Nos. 1, 2, 3 and 4 Spring Wheat, except that they shall be of the White variety, or shall contain 5 per cent, or more, of such White Wheat.

Frosted Wheat shall in no case be graded higher than No. 4, except that the grade of No. 3 may contain as much of said Frosted Wheat as it is customary to allow of Wheat damaged in any other way.

Mixed Wheat. The grades of Nos. 2 and 3 Mixed Wheat shall be equal in quality to the grades of Nos. 2 and 3 Red Winter Wheat, except that they shall include mixtures of Spring and Winter Wheat.

In examining a sample of wheat, it is well to take up each point, one at a time at first, as "hardness" or "texture" and examine the sample for this. Make a note of your observation in each case. After the sample has been carefully examined in this way, make out a brief report on each sample, something after the following plan:

No. SAMPLE	GRADE	WEIGHT PER BUSHEL	REMARKS
1	2 Hard Winter	58 lbs	Horny texture, few "yellow berries."
2	3 Red Winter	56 lbs	Many bleached kernels; lacks plumpness, slightly musty.

TESTING WHEAT FOR PURITY

Standard for Purity 99 per cent.

Test of Purity: Take about a half pint sample and spread on table, carefully separate all impurities, as weed seeds, straws, etc. Then find by weight the amount of pure seed and foreign matter, and calculate per cent of purity.

Examine the foreign matter carefully and identify the varieties of weed seeds found.

TESTING WHEAT FOR VIABILITY

Standard for Germination 90-95 per cent.

Sampling: If taking the sample from a bin, do not take it from one spot but thoroughly mix several shovelfuls,

then take out a small sample and select at random from this 100 grains. Place in moist chamber as described on page 61 and moisten daily. Keep as near as possible at a temperature ranging from 80° to 90°F. Germination should begin in three days, and be complete in about six.

When the radicle has reached a length of $\frac{1}{4}$ inch or more, the germination is sufficient. Remove the sprouted grains daily until germination has ceased, then by counting the number of grains left and subtracting this number from 100, you have the per cent of germination.

CORN

CLASSIFICATION OF SPECIES.

The different groups of corn are classified as follows:

Order	<i>Gramineae</i>
Genus	<i>Zea</i>
Species	<i>Mays</i>
Groups	

Zea tunicate, the pod corn.

Each kernel is enclosed in a pod or husk, and the ear enclosed in husks. Rare. Very leafy, hence called "Cow corn."

Z. evorta, the pop corn.

Characterized by the excessive proportion of corneous endosperm and the small size of the kernels and ear. Kernel is pointed oval in form. The best popping varieties are corneous throughout. Popping is caused by the explosion of contained moisture on heating.

Z. indurata, the flint corns.

Characterized by starchy endosperm enclosed in corneous endosperm. They are oval in form. In some varieties the corneous portion is very thin at top and a slight indentation appears.

Z. indentata, the dent corns.

Characterized by corneous endosperm at the sides

of the kernel, the starchy endosperm extending to the summit. By drying and shrinkage of the starchy matter the summit of the kernel is drawn in or together, and indented in various forms. The kernel is long and wedge shaped. Most extensively grown, and has largest number of varieties.

Z. amyloacea, the soft corns.

Characterized by the absence of corneous endosperm. All starchy. No indentation. Shrinks uniformly. Shaped like flint but soft.

Z. saccharata, the sweet corns.

Characterized by the translucent, horny appearance of the kernel, and the more or less wrinkled, or shriveled condition.

Shrinking due to change of starch to glucose. Wedge shaped kernel.

Varieties of Corn.

The so-called varieties of corn are, like those of wheat, very numerous.

Varieties of the dent type are most commonly grown in this country.

Flint corn ripens earlier and is adapted to the more northern latitudes.

Dent corn grows larger and yields heavier.

While there are numerous so-called varieties, there are only a few distinct and recognized breeds of uniform characteristics.

Owing to the ease with which varieties are produced each locality generally has varieties peculiarly adapted to it.

LABORATORY STUDY OF SPECIES AND OF CHARACTERS.

EXAMINATION OF SPECIES

Samples on the stalk of the various types of corn are provided.

For each of the six principal groups of corn, carry out the following outline:

Describe a typical ear, as to color, shape, indentation, and depth of grain, length, etc.

Make drawings of both longitudinal and cross-sections of grains, showing by appropriate shading where the germ, the starchy portion, and horny portions of the grain are located.

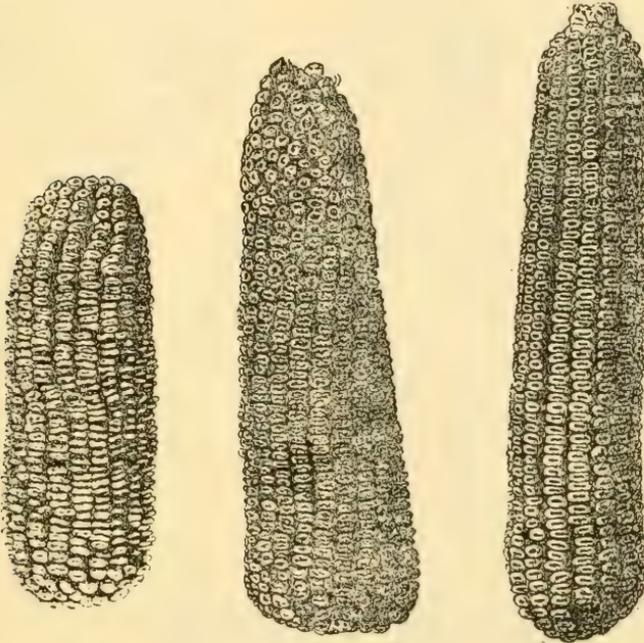


Fig. 1

Fig. 2

Fig. 3

PLATE 7

These three ears of corn possess among them most of the characters covered by the score card. See "Terms for describing characters."

TERMS FOR DESCRIBING CHARACTERS

Shape of Ear.—

Cylindrical (Plate 7, Fig. 1).

Tapering (Pl. 7, Fig. 3).

Very tapering (Pl. 7, Fig. 2).

Length of Ear.—

Long (over 10 inches) (Pl. 7, Fig. 3).

Medium (8 to 10 inches) (Pl. 7, Fig. 2).

Short (under 8 inches) (Pl. 7, Fig. 1).

Circumference of Ear.—

Large (over 8 inches)

Medium (6 to 8 inches).

Small (under 6 inches)



PLATE 8

Typical shapes of kernels.

Color of Kernel.—

Light yellow

Dark yellow

White

Indentation of Kernel.—

Smooth (Pl. 7, Fig. 3).

Dimpled (Pl. 7, Fig. 2).

Deeply dented (Pl. 7, Fig. 1).

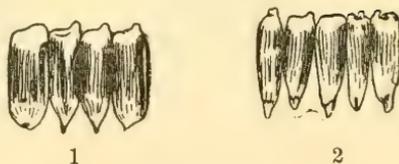


PLATE 9

Side view of typical kernels

Shape of Kernel.—

Wedge (Pl. 8, Fig. 1).

Round (Pl. 8, Fig. 2).

Square (Pl. 8, Fig. 3).

Pointed (Pl. 9, Fig. 2).

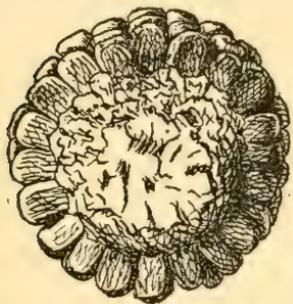
Parallel sided (Pl. 9, Fig. 1).

Length of Kernel.—

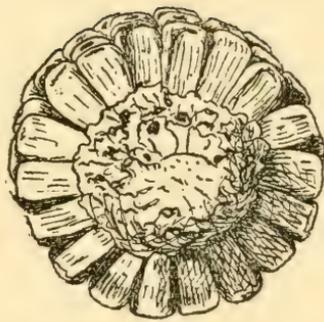
Long (Pl. 10, Fig. 2).

Medium.

Short (Pl. 10, Fig. 1).



1



2

PLATE 10

Cross section of ears. 1, short, round kernels. 2, deep, wedge-shaped kernels.

Number of rows of kernels.—

Many (20 or more).

Medium (14 to 20).

Few (under 14).

Space between rows.—

At cap of kernel.

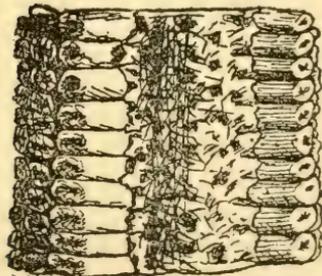
Wide (Pl. 10, Fig. 1).

Close (Pl. 10, Fig. 2).

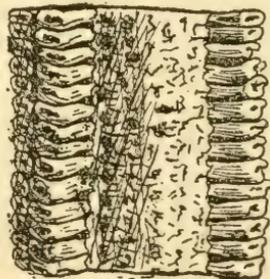
At cob.

Close (Pl. 11, Fig. 1).

Wide (Pl. 11, Fig. 2).



1



2

PLATE 11

Longitudinal sections of ears. 1, kernels close together at cob. 2, kernels far apart at cob.

Arrangement of rows.

Distinct.

Paired.

Tips.

Covered (Pl. 7, Fig. 1).

Exposed (Pl. 7, Fig. 3).

Swell of Butt.

Deeply rounded (Pl. 12, Fig. 2).

Moderately rounded.

Flat (Pl. 12, Fig. 1).

Size of Butt.

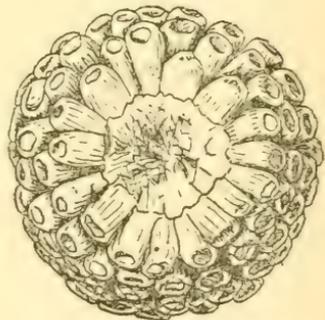
Enlarged (Pl. 7, Fig. 3).

Uniform (Pl. 7, Fig. 1).



1

PLATE 12



2

Butts of ears. 1, poorly filled butt, shank too large. 2, well filled butt, shank small.

Size of Shank.

Small (Pl. 12, Fig. 2).

Medium.

Large (Pl. 12, Fig. 1).

Size of Cob.

Small.

Medium.

Large.

Color of Cob.

Red.

White.

For this exercise select ears or kernels that possess each of the characters mentioned under each head.

OUTLINE FOR DESCRIBING CORN

Variety name	Number of sample....
EAR	At cob
Shape .....	.....
.....	Arrangement
Length .....	.....
.....	TIP
Circumference .....	.....
.....	BUTT
KERNEL	Swell
Color .....	.....
.....	Size
Indentation .....	.....
.....	SHANK
Shape	Size
.....
Length .....	.....
.....	COB
ROWS	Size
Number .....	.....
.....	Color
Space .....	.....
.....
At cap .....	.....
.....
Student's name	Date.....

OUTLINE FOR COMPARING VARIETY TYPES

Take a representative ear of each of two varieties of corn and fill in spaces with an appropriate description of each.

Shape.—Cylindrical, Slightly tapering, Tapering, Very tapering.

1. Boone County White
2. Reid's Yellow Dent

Length.—Give length from butt to tip in inches.

1. Boone County White
2. Reid's Yellow Dent

Circumference.—Give circumference of ear at one-third the distance from the butt.

1. Boone County White

2. Reid's Yellow Dent

Color of Kernel.—Light yellow, Dark yellow, White.

1. Boone County White

2. Reid's Yellow Dent

Indentation of Kernel.—Smooth, Dimpled, Dented, Deeply dented.

1. Boone County White

2. Reid's Yellow Dent

Shape of Kernel.—Wedge, Round, Square, Rectangular.

1. Boone County White

2. Reid's Yellow Dent

Length of Kernel.—Measure from crown to tip of true kernel.

1. Boone County White

2. Reid's Yellow Dent

Number of rows of Kernels.—

1. Boone County White

2. Reid's Yellow Dent

Space between rows.—Measure in 32d parts of an inch.

1. Boone County White

2. Reid's Yellow Dent

Arrangement of rows.—Distinct, Paired.

1. Boone County White

2. Reid's Yellow Dent

Butts.—Deeply rounded, Moderately rounded, Flat, Enlarged, Uniform.

1. Boone County White

2. Reid's Yellow Dent

Shank.—Small, Medium, Large.

1. Boone County White

2. Reid's Yellow Dent

Size of Cob.—Small, Medium, Large.

1. Boone County White

2. Reid's Yellow Dent

Color of Cob.—Red, White.

1. Boone County White
2. Reid's Yellow Dent

JUDGING CORN.

Results obtained by numerous seed corn growers have demonstrated beyond doubt that the productiveness of corn can be greatly increased by the selection of ears having certain desirable qualities for seed. All of the well known varieties of corn have been developed by years of careful selection of seed ears. The principle involved is that an ear of corn when planted reproduces more or less closely its own characteristics in the resulting ears. By selecting for seed, ears of uniform size, deep kernels and other desirable characters, we largely avoid the production of nubbins, shallow kernels and other objectionable points and thus increase the yield.

POINTS TO BE OBSERVED

Uniformity of Exhibit.—The points that go to produce uniformity of exhibit are size, shape and color of ear, appearance of tips and butts, and indentation of kernel. The ears should closely resemble each other in these characters. In other words each ear should look as much as possible like every other ear. In considering this point the judge is not called upon to decide as to the desirability of the characters possessed by the different ears, but solely as to their similarity.

The judge places the ten ears side by side on a table or bench with the butts towards him. He then by removing one ear and replacing it by another, sorts over the exhibit until he has the similar ears lying side by side. If there are six similar ears of one type and four of another, he credits the exhibit with six similar ears, even should these not be so desirable as those of the other type.

Shape of Ears.—Leaving the exhibit arranged as before, count the number of ears that are cylindrical or nearly so.

Credit the exhibit with such ears only. A cylindrical ear is desirable because it permits the growth of kernels of uniform shape, and such ears generally have a larger proportion of corn to cob. A tapering ear must have kernels becoming smaller from butt to tip or else must drop out one row or more entirely between the butt and tip. In either case badly shaped and small kernels are produced.

Color of Cobs.—The color of the cob is, to some extent, a guide to the purity of breeding of the exhibit. The presence of a white cob in an exhibit of otherwise red cobs is an indication that at some time there has been a cross with a white cob variety. This may have occurred many years before, and may not be a present detriment to the corn, but, on the other hand, it may have been detrimental and for that reason is discountenanced. The same is true of the presence of a red cob in an exhibit of otherwise white ones. Some varieties of corn having white kernels have red cobs, but in such a case there should be no white cobs in the exhibit.

Color of Kernels.—A yellow kernel on a white ear or a white kernel on a yellow ear shows that the corn has been fertilized by pollen from corn of another color. In other words it shows that the variety is not strictly pure. The cross fertilization may have occurred in the year in which the ear was raised or it may be of earlier date; there is no way of distinguishing, but the fact is equally objectionable in either case.

Each kernel on the ear results from the fertilization of its ovary by pollen from the same plant or some other. The pollen is borne on the tassel. If any ovary is fertilized by pollen from corn of a different color, the resulting kernel will be of a different color from the rest of the ear.

A mixed kernel on a yellow ear may be readily seen as the crown of the kernel is white. On a white ear, the crown of a mixed kernel hardly shows the yellow color, but it may be seen on the part of the kernel beneath the

crown. They are therefore harder to discover, and the judge must look very carefully.

Market Condition.—The market condition of corn depends most largely upon its ripeness. Other conditions such as freedom from smut or worms, and brightness of color also enter into consideration to some extent. The degree of maturity is commonly determined by the firmness or looseness of the kernels on the cob, and by the stiffness of the cob. Take in turn each ear in the hand and attempt to twist it. If the cob twists readily it is not well matured. If the cob is stiff see if the kernels are loose on the cob. Looseness of the kernels indicates immaturity.

Tips of Ears.—The tips of the cobs are very likely to protrude beyond the kernels. The extent to which this occurs will vary with the season, and with the strain of corn. The reason that the tips are considered in selecting corn for seed is that on account of the tips being the last part of the ear to throw out silks, there is a possibility that the strain may acquire the habit of developing the tip silks too late to be fertilized should ears without tip kernels be continually selected for seed.

On the other hand it is argued that in the main, tips that are well filled out are found on ears of less than average length, and that their selection for seed must result in shortening the ear. However, where a certain length of ear is a requisite for seed corn, it is doubtful whether this argument will hold.

Butts of Ears.—As the ideal ear is cylindrical in shape, the butt should be uniform in diameter with the rest of the ear. It should be well rounded and symmetrical, the rows extending in a uniform way well over and around the shank. The butt should not be expanded or enlarged, since this usually goes with an abnormally large shank which makes husking more difficult. The expanded butt is generally due to an enlargement of the cob, and is not well filled over while the kernels are short and irregular,

thus reducing the percentage of corn. On the other hand the butt may be contracted or filled over too far. In either case the shank is apt to be too small, increasing the tendency of the ears to drop off before husking time.

Uniformity of Kernels.—The kernel shape varies with varieties, but whatever the shape, if the corn is a well selected variety, the kernels should be similar in shape. In judging for uniformity, first remove two kernels from near the middle of each ear and lay them near one end of the ear with the tips of the kernels toward you. In this way remove two kernels from each ear, placing the ears and pairs of kernels side by side, when the comparative size, shape, etc., of the different pairs of kernels may be noted.

The indentation of the kernels is best compared on the ears. Count the number of ears having kernels which are in a general way uniform and score the exhibit accordingly.

Shape of Kernels.—In general the shape of the kernel should be that of a wedge, as this shape permits the greatest amount of corn on the cob. The kernels should be of such shape that they fit snugly from tip to crown. If the kernels are too wedge shaped there is a loss of space at the tips of kernels, while if they are too rectangular there will be wide spaces between the rows at the crown. The kernels should not be too thin at the tip but about the same thickness as at the crown. Pointed, thin kernels are often low in vitality and of less feeding value than kernels having plump, well developed tips. In judging shape of kernel, remove a few kernels from near the middle of the ear, and examine the kernels on the ear, noting the spacing between the tips and crowns, and how closely they fit.

The length and indentation of the kernels should also be noted. A good indentation is of importance, since a deep indentation seems to go with a deep grain. In pick-

ing seed ears, only well indented ears should be selected, as this is the only practical way of keeping up a good depth of kernel.

Space between Kernels.—The space between kernels is closely correlated with shape of kernels. Well shaped kernels should have no lost space between rows either at tips or crowns. In examining spaces between rows, remove several kernels near the middle of the ear, and examine the space between tips of kernels, both when looking at the side of the row and the ends of the rows. Then examine the spaces between rows at the top of kernels; this should as a general thing be less than $1/32$ d inch, though this rule cannot be rigidly observed. Too much space not only results in poorly shaped and irregular kernels, but in a decreased percentage of corn.

Proportion of Corn on Ear.—The reason for determining this point is primarily to discourage the production of a large cob, while it also encourages a deep kernel. The effect of this point in connection with the following one is to prevent the growth of an ear unduly large in circumference in proportion to its length.

The proportion of corn on the ear is determined by weighing five representative ears of the exhibit, shelling the grain, and reweighing the cobs. The difference between these weights divided by the weight of the ears gives the per cent of corn on the ear.

Weight of Corn on Ear.—While a very large ear of corn is not, under all conditions desirable for seed, it is to be desired that an ear of a given length should possess a maximum quantity of grain. By requiring an ear of given length to shell out a certain weight of grain, a deep kernel is placed at a premium, as is also a heavy kernel. The danger of producing a deep but light weight kernel is thus avoided.

It is well understood that a deep kernel requires a long growing period for its development. Should the growing

season not be favorable or should the attempt be made to raise a type of corn having a kernel too deep for the climate in which it is planted, the result would be a comparatively deep but light weight kernel. To discourage this the weight requirement is made.

SCORE CARD FOR CORN

Variety nameNumber of exhibit.....

	VALUE	STUDENT'S SCORE	CORRECTED SCORE
Uniformity of exhibit.....	10	.....	.....
Shape of ears.....	10	.....	.....
Color of cob	5	.....	.....
Color of kernels.....	5	.....	.....
Market condition	10	.....	.....
Tips of ears	5	.....	.....
Butts of ears	5	.....	.....
Uniformity of kernels.....	10	.....	.....
Shape of kernels.....	10	.....	.....
Space between kernels	5	.....	.....
Proportion of corn on ear.....	10	.....	.....
Weight of grain	15	.....	.....

Student's NameDate.....

RULES FOR JUDGING EXHIBITS OF CORN

Uniformity of Exhibit.—The ears in an exhibit should be similar in size, shape, color and indentation. For each ear deficient in these respects, cut the exhibit one point.

Shape of Ears.—The ears should be cylindrical or nearly so. Cut the exhibit one point for each ear deviating from this requirement.

Color of Cob.—The cobs should be uniformly red or uniformly white. For each white cob in an exhibit in which the red predominate, cut the exhibit one-half point. Do the same for each red cob in an exhibit of white cobs.

Color of Kernels.—For each white crowned kernel in a yellow or red variety, cut the exhibit one-tenth point. For each yellow kernel in a white variety, give the same cut.

Market Condition.—The corn should be well matured, firm and sound. For each ear deficient in these respects, cut the exhibit one point.

Tips of Ears.—The tips of the ears should be covered with regular, uniform kernels. Add together the lengths of protruding cobs on all ears of the exhibit, and cut at the rate of one-half point for each inch.

Butts of Ears.—The rows of kernels should be even and swell out evenly beyond the end of the cob. Cut the exhibit one-half point for each poorly filled butt, and one-fourth point for each flat butt.

Uniformity of Kernels.—The kernels should possess similar characters. Cut the exhibit one-half point for each deficient ear.

Shape of Kernels.—The kernels should have a wedge shape on the broad side, and on the narrow side the edges should be parallel. Cut one point each for each objectionable ear.

Space Between Kernels.—The rows of kernels should not be more than one-thirty-second of an inch apart at any part of the row. If more than one-sixteenth of an inch apart, cut one-half point, if less than that but more than one-thirty-second, cut one-fourth point for each ear.

Proportion of Corn on Ear.—The proportion of corn on the ear should not be less than 85 per cent. For every per cent below eighty-five, cut the exhibit one point.

Weight of Grain.—The weight of grain on an average ear should come up to the following requirements:

Length of Ear 12 inches and over, weight of grain 17 ounces.

Length of Ear 11 to 12 inches, weight of grain 15 ounces.

Length of Ear 10 to 11 inches, weight of grain 14 ounces.

Length of Ear 9 to 10 inches, weight of grain 13 ounces.

Length of Ear 8 to 9 inches, weight of grain 11.5 ounces.

Length of Ear 7 to 8 inches, weight of grain 9.5 ounces.

Length of Ear 6 to 7 inches, weight of grain 8 ounces.

For each ounce below the number required by an ear of given length, cut the exhibit one point.

TESTING CORN FOR VIABILITY.

Standard for Germination 90–95 per cent.

Sampling.—The importance of making germination tests of corn cannot be emphasized too strongly since seed corn will often have a fair outward appearance and yet germinate poorly.

When the germinating power of corn is very low, and reliable seed is hard to pick out, it is often desirable to make germination tests of each ear separately.

To do this, first number the ears by slipping a piece of cardboard containing the number between two rows. Then remove one grain from the butt, middle and tip of each ear. Then taking your germinator, as described on page 61, mark off the blotting paper in the bottom into inch squares, numbering each. Now put the grains from each ear in their respective square, and allow to germinate.

In this way several hundred ears may be tested at once.

For testing a large lot of corn in the ear, select 100 ears at random and take one grain from each of these about two inches from the butt. More corn seems to germinate poorly near the butt than at any other point. Place seed in germinator. Germination should begin in about two days and be complete in six.

For best results keep temperature as near 80° to 90° F. as possible, and never let fall below 60° F.

GRADING CORN.

The grades of corn are usually designated "White Corn", "Yellow Corn", or in case of a mixture of the two (amounting to more than 25 per cent), it is simply called "Corn."

Usually three grades of White and Yellow corn are made, and four grades of the Mixed corn. In examining and grading corn, the student should take into consideration the following points:

POINTS TO BE OBSERVED

Color.—No. 1 Corn should be true to color, but in grades 2 and 3, considerable mixture is allowed, varying from 10 per cent to 25 per cent.

Soundness. Good corn should not only be thoroughly cleaned up, but be reasonably free from decayed or cracked kernels. Cracked kernels often indicate that the corn was damp when shelled. Any considerable per cent of chaffy or shrunken kernels injures both the feeding and milling value of the corn.

Moisture. Corn in a wet or heating condition cannot be graded.

Go over each sample carefully and make out a short report on each, giving first the commercial grade, then note the amount of mixture, if mixed, also the kind and nature of any impurities or injury the grain may have suffered from exposure, sprouting, or heating in crib or bin. The following form of report is suggested:

SAMPLE NO.	GRADE	REMARKS

For this work 20 to 25 samples of corn are provided. These should include samples of pure yellow and white corn of the various grades, in various stages of cleanliness, dampness, etc. Also samples of mixed corn, starting in with pure white and yellow and mixing them in various proportions.

CORN INSPECTION RULES*

No. 1 Yellow Corn shall be yellow, sound, dry, plump, and well cleaned.

No. 2 Yellow Corn shall be three-fourths yellow, dry, reasonably clean, but not plump enough for No. 1.

No. 3 Yellow Corn shall be three-fourths yellow, reasonably dry, and reasonably clean, but not sufficiently sound for No. 2.

No. 1 White Corn shall be sound, dry, plump, and well cleaned.

No. 2 White Corn shall be seven-eighths white, dry, reasonably clean, but not plump enough for No. 1.

No. 3 White Corn shall be seven-eighths white, reasonably dry and reasonably clean, but not sufficiently sound for No. 2.

No. 1 Corn shall be mixed corn of choice quality, sound, dry and well cleaned.

No. 2 Corn shall be mixed corn, dry and reasonably clean, but not good enough for No. 1.

No. 3 Corn shall be mixed corn, reasonably dry and reasonably clean, but not sufficiently sound for No. 2.

No. 4 Corn—Corn that is badly damaged, damp or very dirty shall be graded no higher than No. 4.

Corn that is wet or in heating condition shall not be graded.

OATS

CLASSIFICATION OF SPECIES.

Order	<i>Gramineae</i>
Genus	<i>Avena</i>
Species	<i>Sativa</i>

The cultivated varieties are sometimes classified according to the form of the panicle, and considered by some botanists as distinct species. The "common oat"—*Avena sativa*—comprising those varieties having spreading pan-

*Rules adopted by the Board of Railroad and Warehouse Commissioners for the inspection of grain at Chicago.

icles, and the "Tartarian oat"—*Avena orientalis*—comprising varieties with close, erect panicles commonly called "side oats" while the other is called "branch oats."

There is also a type, *Avena nuda*, from which the hull is removed in threshing. Varieties of this are found in both of the above groups.

The hulled varieties are also divided, according to the color of the hull, into white, gray, red, and black oats.

The oat differs from the other cereals in having its heads in the form of panicles instead of spikes and the grain is not attached directly to the main stem of the plant.

In form of grain and height of straw varieties differ considerably.

A good oat grain should be fairly plump, have a thin hull and weigh 32 to 35 pounds per measured bushel.

The stalk should be of medium height, having a long panicle and stand erect.

As in the case of most other cereals the varieties of oats are very numerous and adapted to different conditions.

In regard to yield and quality there seems to be on an average no particular difference between varieties of different color, or varieties with open or closed panicles. The differences seem to be due solely to induced variety characteristics.

The shape of the grain varies considerably in different varieties, some being very long and having a large proportion of hull.

In the southern regions the proportion of hull to kernel tends to increase.

Remove hulls of several varieties and get proportion by weighing. (Hulls are more easily removed if soaked in a dilute solution of potassium hydrate or 33 per cent alcohol for a few minutes.)

(It will be noted that the kernel is enclosed in a hull. The feeding value is decreased by a large proportion of this hull.)

LABORATORY STUDY OF CHARACTERS.

Examine in head samples of common varieties of side and paniced oats.

Draw a branch and two or three spikelets.

Dissect out carefully a spikelet and draw its parts in their relative position.

Now examine each head carefully and note down its characteristics in the "Outline for Describing Oats", using the list of descriptive terms as a guide.

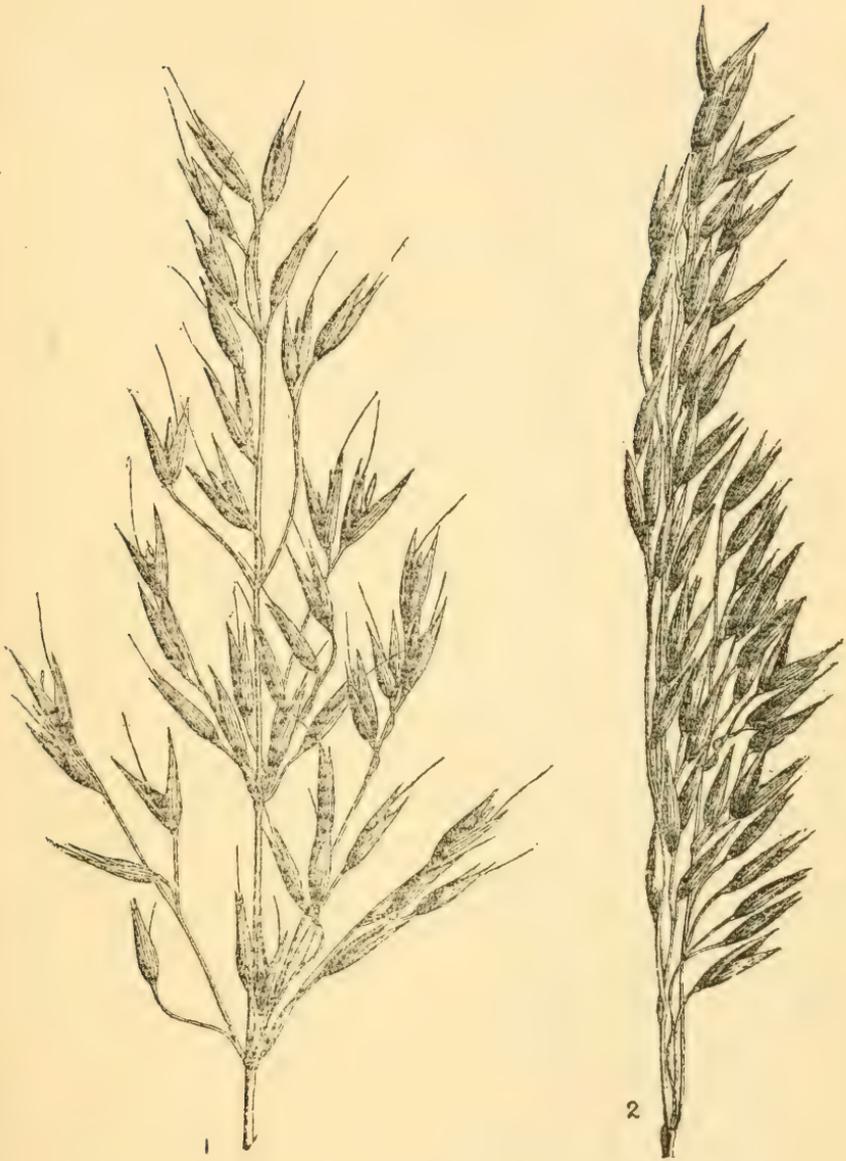


PLATE 13

Types of oat heads; No. 1, paniced oats; No. 2, side oats.

TERMS FOR DESCRIBING CHARACTERS

Variety nameNumber of sample....

PANICLE

Shape

- { Open (Pl. 13, Fig. 1)
- { Spreading
- 1. { Compressed
- { Side panicle
- { (Pl. 13, Fig. 2) } Loose
- { Compressed
- 2. Length (inches)

Color

- { Whitish
- { Yellowish
- { Yellow brown
- { Brown
- { Reddish
- { Black
- { Gray

SPIKELET

- 1. { Spreading
- { Narrow
- 2. Number grains 1, 2, 3.

Outer Glume

- { Tip awn pointed
- 1. { Tip acute
- { Tip blunt
- { Broad
- 2. { Medium
- { Narrow

GRAIN

Shape

- { Long (Pl. 14, Fig. 1)
- 1. { Medium
- { Short (Pl. 14, Fig. 2)
- { Thin (Pl. 14, Fig. 1)
- 2. { Medium
- { Plump (Pl. 14, Fig. 2)
- 3. { Pointed at base
- { Blunt at base

4. Wt. 100 grains

Tip

1. { Long (Pl. 14, Fig. 1) }
 { Medium } (Refers to extension of hull beyond
 { Short (Pl. 14, Fig. 2) } the naked grain.)

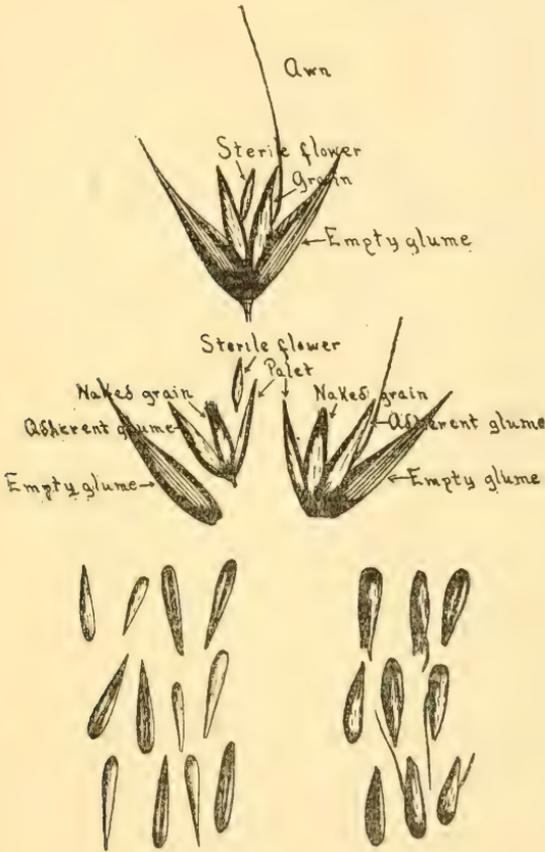


Fig. 1

Fig. 2

PLATE 14

The upper figures show an entire oat spikelet, both in its natural form and when torn apart, with all parts named. The lower figures show two types of oat kernels.

2. { Pointed (Pl. 14, Fig. 1)
 { Blunt (Pl. 14, Fig. 2)

Hull

1. { Thick
Medium
Thin

2. Per cent

Color

- { Whitish
Yellowish
Brownish
Reddish
Black

Dorsal Awns

1. { Long
Medium
Short
None

2. { Slender
Medium
Stout

3. { Deciduous
Persistent

Color

1. { Whitish
Brownish
Yellowish
Black

2. { Brown or black at base
and lighter at tip

OUTLINE FOR DESCRIBING OATS

Variety Name Number of Sample....

PANICLE	Tip
Shape	1
1	2
2	Hull
Color	1
1	2
SPIKELET	Color
1	1
2	
Outer Glume	Dorsal Awn
1	1
2	2
	3
GRAIN	Color
Shape	1
1	2
2	
3	

Student's Name Date

EXAMINING AND GRADING OATS.

For this work about 20 samples of oats are provided including one sample of each commercial grade.

POINTS TO BE OBSERVED

Mustiness. Oats should be free from must as it injures the palatability and feeding value of the grain; also giving horses a cough.

Purity. Oats should be fairly clean, but more foreign matter is allowed in oats than in corresponding grades of other grain.

An occasional grain of corn or wheat is not so objectionable in a grain used largely for feeding purposes as in a grain for milling.

Weed stems and seeds are not only worthless but may give a bad taste to the grain.

Plumpness. Other things being equal, a plump berry is always preferred, since it usually has a less proportion of hull, and consequently higher feeding value.

Soundness. Decayed and weather beaten grain not only suffers in appearance, but the feeding quality is injured, since only a small amount is sufficient to injure that sweet, palatable flavor, which bright, clean oats should have.

Weight. The weight per bushel is a good indication of the feeding value of an oat since lighter oats have a larger proportion of hull to berry than heavy oats.

Good oats should weigh at least thirty-two pounds per bushel.

A No. 3 oats may weigh as low as twenty-two pounds if it is bright and clean.

OAT INSPECTION RULES*

No. 1 White Oats shall be white, sound, clean, and reasonably free from other grain, weight 32 pounds.

No. 2 White Oats shall be seven-eighths white, sweet, reasonably clean, and reasonably free from other grain, weight 28 pounds or above.

No. 3 White Oats shall be seven-eighths white, but not sufficiently sound and clean for No. 2, weight 22 pounds or better.

No. 4 White Oats shall be seven-eighths white, damp, badly damaged, musty, or for any other cause unfit for No. 3.

No. 1 White Clipped Oats shall be white, sound, clean, reasonably free from other grain, and shall weigh not less than thirty-six pounds to the measured bushel.

No. 2 White Clipped Oats shall be seven-eighths white, sweet, reasonably clean, reasonably free from other grain, and shall weigh not less than thirty-four pounds to the measured bushel.

*Rules adopted by the Board of Railroad and Warehouse Commissioners for the inspection of grain at Chicago.

No. 3 White Clipped Oats shall be seven-eighths white, not sufficiently sound or clean for No. 2, and shall weigh not less than twenty-eight pounds to the measured bushel.

No. 1 Oats shall be mixed oats, sound, clean, and reasonably free from other grain.

No. 2 Oats shall be sweet, reasonably clean, and reasonably free from other grain.

No. 3 Oats shall be mixed oats, not sufficiently sound and clean for No. 2.

No. 4 Oats shall be all mixed oats that are damp, badly damaged, musty, or for any other cause unfit for No. 3.

In examining and grading the samples of oats, take up each point separately, as in wheat, making notes of your observations, and report on each, after the following manner:

NO. SAMPLE	GRADE	REMARKS
1	No. 2 Wheat	Weight 30 lbs. per bushel, grains plump; slightly mixture of corn; sweet and bright.

TESTING OATS FOR PURITY

Standard for Purity 99 per cent.

Test of Purity: Thoroughly mix the oats to be tested and take out about a half pint sample. Spread this on a table and carefully separate out the impurities. Then find by weight the amount of pure seed, as well as the foreign matter and from this calculate the per cent of purity.

An oat sample may sometimes contain as much as 5 per cent foreign matter and still pass the casual observer as a fairly clean sample.

TESTING OATS FOR VIABILITY

Standard Germination for oats 95 per cent.

Sampling: If taking a sample for germination from a bin, do not take it from one place, but mix up thoroughly

several scoopfuls taken from different parts of the bin, then from this take a small sample and pick out at random 100 grains. Place these in germinating apparatus as described on page 61.

Moisten daily and keep at temperature of 80° to 90° F. Germination should begin in three days. As soon as the radicle is $\frac{1}{4}$ in. long the grain has germinated.

Remove all sprouted grains daily until germination ceases. Then by counting the number which failed to sprout and subtracting this from 100, you have the per cent of germination.

BARLEY

CLASSIFICATION OF SPECIES AND VARIETIES.

Order	<i>Gramineae</i>
Genus	<i>Hordeum</i>
Species	<i>Sativum</i>

Cultivated barleys include a number of types, or races which by some are considered as sub-species and classified as follows:

1. Two-rowed barley... *Hordeum sativum distichon*
2. Four-rowed barley... *Hordeum sativum vulgare*
3. Six-rowed barley... *Hordeum sativum hexastichon*

The two-rowed barleys commonly grown are characterized by their large plump grain, and amongst these are found the best varieties for malting purposes.

The four-rowed and six-rowed barleys include the "naked" or "hulless" varieties.

In the six-rowed barleys the grains are smaller and generally inferior in quality to either of the others.

The four and six-rowed varieties are generally most prolific and are most commonly grown in this country for feeding purposes.

The varieties of barley are numerous but only a comparatively few are grown in the United States.

Carefully examine samples of each of the above types of barley, including samples of both black and white "hulless" barley.

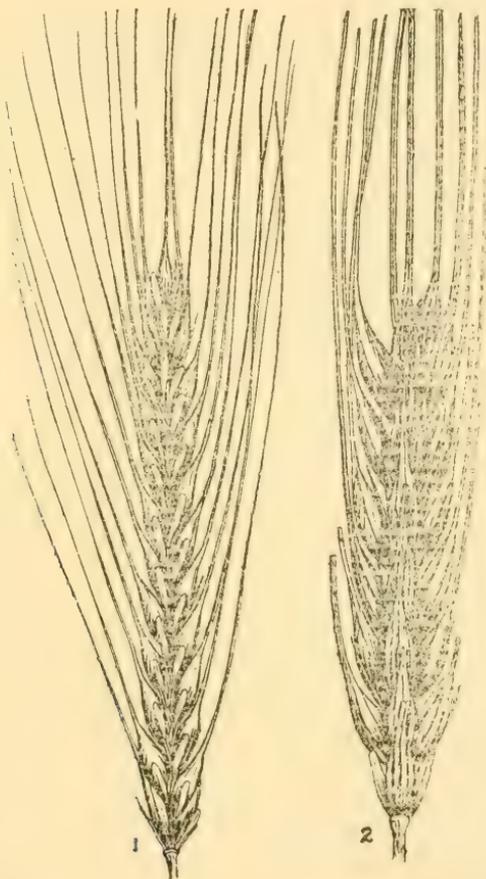


PLATE 15

Types of barley spikes. No. 1, two-rowed brewing barley;
No. 2, six-rowed hulless barley.

Make drawings from a spike of each type, showing the imbricated view.

Note that the grain of ordinary barley is tightly en-

closed by the flowering glume, called the "hull" while in hulless barleys the flowering glume and palet do not adhere closely and the grain is free.

In this respect hulled barley is comparable to oats and hulless to wheat.

Typical samples in the spike and of the threshed grain are provided. Carefully describe both the spike and grain of one or more samples each of the principal types of barley, as the two, four and six-rowed barleys, and black and white hulless barleys.

The characteristics are obvious enough so that with a little careful comparison there should be no trouble in finding the proper adjective in the descriptive list.

Use the Outline for describing barleys, filling it out carefully.

TERMS FOR DESCRIBING CHARACTERS

SPIKE

1. { Two-rowed (Pl. 15, Fig. 1)
Four-rowed
Six-rowed (Pl. 15, Fig. 2) } This refers to the number of rows of grain on the spike.
2. { Awned
Partly awned
Awnless
3. Length (inches)
4. { Open (Pl. 15, Fig. 1)
Compact (Pl. 15, Fig. 2)
Crowded } Has reference to how closely or far apart the spikelets are on the racis.

Shape

1. { Tapering toward tip } When terminal spikelets are not all filled out.
{ Tapering both ways } When spikelets at both base and tip are more oppressed than those at middle
{ Uniform
2. { Tip acute (Pl. 15, Fig. 1)
Tip blunt (Pl. 15, Fig. 2) } Terminal spikelet well filled out
3. { Base abrupt }
{ Base tapering } Basal spikelets well filled out.
4. Sterile Spikelets, 1, 2, 3, etc.

Color

1. { Whitish
Yellowish
Yellowish brown
Brown
Black

AWNS

1. { Long (Length 5 inches or more)
Medium (Length 3 to 5 inches)
Short (Length less than 3 inches)
2. { Parallel (Pl. 15, Fig. 2)
Spreading (Pl. 15, Fig. 1) } Refers to the relative position of the awns to the head.
This refers to the dropping of the awns at maturity. The awns all drop off on some varieties while on others they are very persistent.
3. { Deciduous
Partly deciduous (Pl. 15, Fig. 2)
Persistent (Pl. 15, Fig. 1) }

Color

1. { Whitish
Yellowish
Brownish
Black

SPIKELET

(This is not a spikelet in the botanical sense, but really a mesh of three spikelets.)

1. Number grains, 1, 2, 3 (number of grains per spikelet).
2. Number of sterile flowers (Refers to sterile flowers in a spikelet).

Size

1. { Broad (Pl. 16, Fig. 3)
Medium
Narrow (Pl. 16, Fig. 2) } This depends largely on the shape of the grain and how well it is developed.

Outer Glume (In barleys, these are very narrow and pointed.)

1. { Awned (Pl. 16, Fig. 3)
Awn pointed
Awnless (Pl. 16, Fig. 4) } The outer or empty glume should not be confused with the flowering or seed bearing glume.

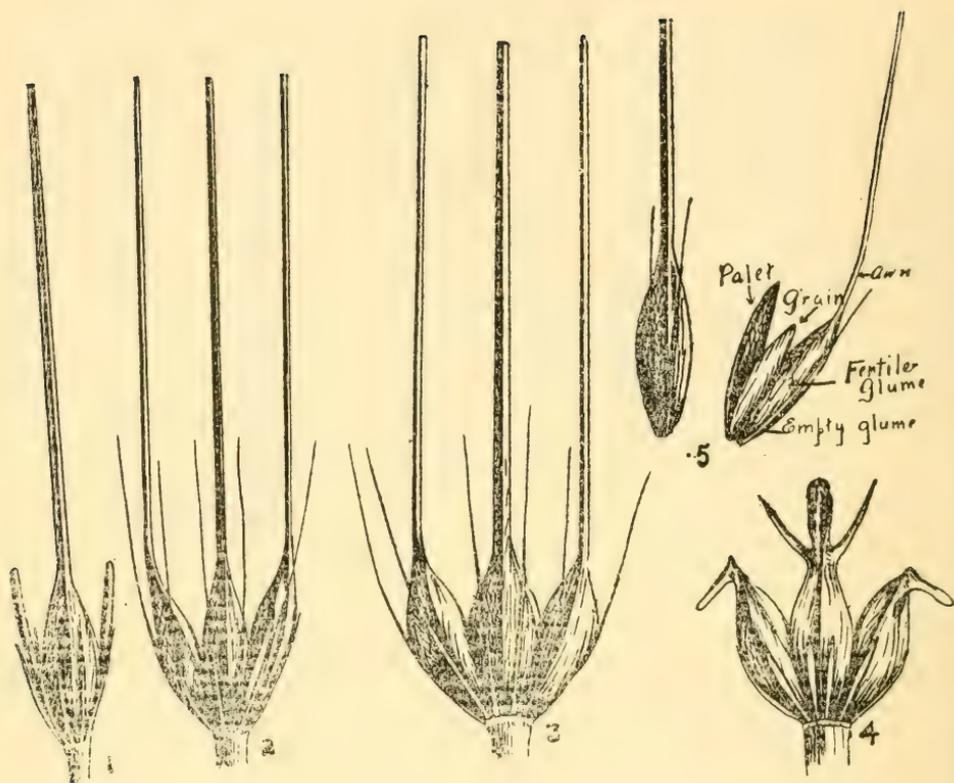


PLATE 16

Types of barley spikelets. No. 1, spikelet from two-rowed barley; No. 2, spikelet from six-rowed barley; No. 3, a six-rowed hullless barley; No. 4, a white hullless and awnless barley; No. 5, shows a barley spikelet torn apart.

GRAIN

1. { Enclosed in flowering glume }
 { Free (naked) }

This is the distinguishing characteristic between the naked or hullless barley and the ordinary kind. In the latter the grain is so tightly enclosed that it is not freed in threshing.

2. { Hard } This point is most easily determined by biting or
 { Medium } cutting the grains and comparing with standard
 { Soft } samples

Shape

1. { Long } Different varieties of barley show considerable varia-
 { Medium } tion in size and ratio of length to diameter. Pick
 { Short } out about six typical kernels to examine for these
 points.

2. { Thin
Medium
Plump }
3. { Flat-cheeked
Plump-cheeked
Angular-cheeked } The cheek is that portion of the grain on either side of the suture.
4. { Pointed at tip
Blunt at tip } The tip of the kernel is opposite the germ end.
5. { Pointed at base
Blunt at base } The base of the kernel is the germ end.

Crease

1. { Deep
Medium
Shallow } Cut cross sections of several typical grains.

Cross-section

1. { Horny
Dull
Starchy } This point is determined by making cross sections and examining carefully. Where only part of the grains show one characteristic, and the rest some other, the per cent of each kind should be expressed.

When Seed is Enclosed

(When the grain is enclosed in the glume, not "hulless.")

1. { Rounded (dorsal side)
Medium
Flat } Has reference to the shape of the dorsal side of the grain
2. { Strongly nerved
Medium
Obscurely nerved } The barley grain is fine nerved on the back. The prominence of these nerves varies greatly with difference barleys.

Color

1. { Whitish
Yellowish
Brownish }

When Seed is Free (see Fig. —, Hulless barleys).

Color

1. { Black
Purple
Purplish
Brown
Yellowish
Whitish } When black barleys are fully matured, they are purplish black in color, but when cut very green they are often a yellowish white in color, with only a tinge of purple.

OUTLINE FOR DESCRIBING BARLEYS

Variety Name	Number of Sample....
SPIKE	Outer Glume
1	1
2	GRAIN
3	1
4	2
Shape	Shape
1	1
2	2
3	3
4	4
Color	5
1	Crease
AWNS	1
1	Cross-section
2	1
3	When Seed is Enclosed
Color	Dorsal Side
1	1
SPIKELET	2
1	When Seed is Free
2	Color
Size	1
1	
Student's Name	Date

EXAMINING AND GRADING BARLEYS.

For this work some 25 or more samples of barley are provided, covering all grades.

In judging barley from the brewer's standpoint, only good unbleached samples can be used, while from a feeder's standpoint a slight discoloration would be no objection.

The price of white barley is governed by the brewing qualities of the grain. Any discoloring or bleaching disqualifies it for this purpose.

A few points to be observed in grading barleys are as follows:

POINTS TO BE OBSERVED

Color: White barleys should be a clear, light color with no tint of yellow or brown.

Bleaching and discoloring caused from exposure to weather is probably the most common cause of injury to white barleys. Bleaching not only disqualifies barley for malting purposes by injuring the color of the product, but the wetting and drying which the grain is subjected to when bleached, injures its malting properties.

Black barleys when fully matured are usually a blue-black, but if harvested before fully matured, many of the grains will be brownish, with varying degrees of purple or blue, shading to almost black.

Texture: The texture of barleys varies from quite hard, and horny, (vitreous in appearance) to a crumbly texture, white and very starchy.

A good way to examine both the texture and hardness of a barley at the same time is to bite several grains in two. The difference in hardness and texture is directly correlated with the variation in proteid content. The very soft and starchy barleys contain the least proteids, about 8 per cent or 10 per cent, while barleys with a hard, horny texture, and usually vitreous appearance, sometimes contain as high as 15 per cent proteids.

Brewing Qualities: German brewers generally prefer barleys of very low proteid content, from 7 per cent to 9 per cent, claiming that barleys containing a high per cent of proteids not only give a less per cent of extract, but a beer subject to turbidity. However, American brewers are using with good success, many western and northern barleys containing as high as 12 per cent to 14 per cent proteids.

The two-rowed barleys are generally known as "brewing barleys" and in the past have been preferred by many brewers, especially in Europe, but most American barleys are of the six-rowed type, and American brewers do not

seem to make any discrimination in favor of two-rowed barleys.

BARLEY INSPECTION RULES*

No. 1 Barley shall be sound, plump, bright, clean and free from all other grain.

No. 2 Barley shall be of healthy color, not sound enough and plump enough for No. 1, reasonably clean and reasonably free from other grain.

No. 3 Barley shall include slightly shrunken and otherwise slightly damaged barley not good enough for No. 2.

No. 4 Barley shall include all barley fit for malting purposes not good enough for No. 3.

No. 5 Barley shall include all barley which is badly damaged or for any reason is unfit for malting purposes, except that barley which has been chemically treated shall not be graded at all.

Black Barley. The grades Nos. 1, 2, 3 and 4 Black Barley shall conform in all respects to grades Nos. 1, 2, 3 and 4 Barley, except they shall be of the black varieties of barley.

In examining and grading barleys the brewing and feeding qualities should be kept in mind. Note with care the color, texture, brewing and feeding qualities of each sample. Report on these points with the grade of the sample, after the following manner:

NO. SAMPLE	GRADE	REMARKS
2	3	Plump but quite bleached; good feeding value.

TESTING BARLEY FOR PURITY AND VIABILITY.

In testing barley for Purity and Germination, follow the directions given for oats.

*Rules adopted by the Board of Railroad and Warehouse Commissioners for the inspection of grain at Chicago.

HAY PLANTS

The following outline is used in the study of common cultivated grasses and millets. By following the outline, one's attention is called to the distinguishing characteristics of each kind, giving not only a means of identification, but a good knowledge of the grass.

OUTLINE FOR DESCRIBING GRASSES.

THE STEM AND LEAVES.

Height
Color-Stem
Color-Leaves
Number of leaves

HEAD

Awne'd or awnless
Panicled, compact or spiked
Size—(Give length and diameter)
Color-Awns
Color-Chaff

ROOT

Does it spread from rootstocks?.....
Is it a sod forming or bunch grass?.....

EXAMINATION OF GRASS SEEDS

Size—

Give average length in inches.....

Color—

General color

General Notes—

Is seed free or enclosed in scales?

Weight per bushel

Amount sown per acre

Vitality

Drawings—Make drawing from convex side—Make drawing of cross section.

HAY AND STRAW INSPECTION RULES.

The following are the rules and regulations adopted by the Chicago Board of Trade for the inspection of Hay and Straw:

Choice Timothy Hay.—Shall be Timothy not mixed with over one-twentieth other grasses, properly cured, bright natural color, sound and well baled.

No. 1 Timothy Hay.—Shall be Timothy not more than one-fifth mixed with other tame grasses, properly cured, good color, sound and well baled.

No. 2 Timothy Hay.—Shall include Timothy not good enough for No. 1, not over one-third mixed with other tame grasses, sound and well baled.

No. 3 Timothy Hay.—Shall include all Hay not good enough for other grades, sound and well baled.

No. 1 Clover Mixed Hay.—Shall be Timothy and Clover mixed, with at least one-half Timothy, good color, sound and well baled.

No. 2 Clover Mixed Hay.—Shall be Timothy and Clover mixed, with at least one-third Timothy, reasonably sound and well baled.

No. 1 Clover Hay.—Shall be medium Clover, not over one-twentieth other grasses, properly cured, sound and well baled.

No. 2 Clover Hay.—Shall be Clover, sound, well baled, not good enough for No. 1.

No Grade Hay.—Shall include all Hay badly cured, musty stained, threshed, or in any way unsound.

Choice Prairie Hay.—Shall be Upland Hay, of bright color, well cured, sweet, sound and reasonably free from weeds.

No. 1 Prairie Hay.—Shall be Upland and may contain one-quarter Midland of good color, well cured, sweet, sound and reasonably free from weeds.

No. 2 Prairie Hay.—Shall be Upland of fair color, or

Midland of good color, well cured, sweet, sound and reasonably free from weeds.

No. 3 Prairie Hay.—Shall be Midland of fair color, or slough of good color, well cured, sound and reasonably free from weeds.

No. 4 Prairie Hay.—Shall include all Hay not good enough for other grades, and not caked.

No Grade Prairie Hay.—Shall include all Hay not good enough for other grades.

No. 1 Straight Rye Straw.—Shall be in large bales, clean, bright, long Rye Straw, pressed in bundles, sound and well baled.

No. 2 Straight Rye Straw.—Shall be in large bales, long Rye Straw, pressed in bundles, sound and well baled, not good enough for No. 1.

Tangled Rye Straw.—Shall be reasonably clean Rye Straw, good color, sound and well baled.

Wheat Straw.—Shall be reasonably clean Wheat Straw, sound and well baled.

Oat Straw.—Shall be reasonably clean Oat Straw, sound and well baled.

IDENTIFICATION OF CLOVER AND GRASS SEEDS

There is no work which requires more careful attention or is more valuable than the identification of grass and clover seeds and separating them from their adulterants.

For examining the seeds a small tripod lens is very useful. Use the following artificial key which is not intended to describe the seed but simply calls your attention to the most prominent characteristics of each variety.

CLOVER SEEDS

Key for Identification

1. *Seed Free* (Not enclosed in pod.)

(A) Seed bean shaped.

Color; pinkish, $\frac{1}{8}$ in. long.Crimson Clover

Color; mostly yellow; large seeds are kidney
shapeAlfalfa
(Turkestan alfalfa is same but slate colored.)

Color; dark yellow to brownYellow Trefoil

(B) Seed Oval-oblong.

Color; yellow, seed notched near one end....
.....Bokarah Clover

(C) Seed heart shaped.

Color; yellow to brownWhite Clover

Color; dark green to black.....Alsike Clover

(D) Seed somewhat triangular.

Color; yellow to brownishRed Clover

2. *Seed Enclosed in Pod.*

(A) Pod; large and corrugated, $\frac{1}{4}$ in. long.

Color; brown, seed bean shapedSainfoin

(B) Pod; whitish, $\frac{1}{8}$ in. long.

Color; yellow, seed oval, notched near end....
.....Yellow Sweet Clover

(C) Pod; brown, $\frac{1}{8}$ in. long.

Color; dark brown, seed mottled.....Japan Clover

GRASS SEEDS

Key for Identification

Seeds distinctly awned.

Seed $\frac{1}{4}$ in. or more in length.

Very hairy or pubescent, flat, thin..Meadow Fox-tail

Awns attached at tipAnnual Rye Grass

Awns long, twisted, attached near base.....

.....Tall Meadow oat-grass

Seeds less than $\frac{1}{4}$ in. long.

Small brownish seedSheep Fescue

Short awned or awn pointed.

Small dark brown seeds, very rough near tip....

.....Crested Dog's-tail

$\frac{3}{8}$ in. long, smooth, light colored.....Wheat grass

$\frac{1}{4}$ in. or less in lengthOrchard grass

Awnless.

$\frac{3}{8}$ in. long or thereabout, nerves very prominent..

.....Brome Grass

About $\frac{1}{4}$ in. long, } Obscurely, 3-nerved, Perennial Rye grass
 light brown .. } Strongly, 5-nerved, Meadow fescue
 $\frac{1}{8}$ in. long or less.

Keel rough, saw-likeRed Top
 Keel not commonly roughKentucky Bluegrass
 Seed free from glumes, polished.

Very small $\frac{1}{32}$ in. length, polishedTimothy
 Hard, smooth seeds, about $\frac{1}{4}$ in. long..Johnson grass

MILLET SEEDS

Key for Identification

Seeds ovoid, flattened on one side and enclosed in glumes; usually shiny, $\frac{1}{10}$ in. to $\frac{1}{20}$ in. in length.

Seed red or pinkSiberian millet

Seed yellowGerman millet

Seed mostly blackHungarian grass

Seed dull brown, outer covering loose and rough

.....Japanese barnyard millet

Seed brownish-yellow (Varieties of this millet are

white and others red)Hog millet

APPARATUS FOR GERMINATING SEEDS

Germination tests are easily made, even with the simplest apparatus.

A seed incubator is generally made on the plan of an oven, double walled and often covered with asbestos. The space between the double walls may be filled with water. This is usually heated with a gas jet or lamp so arranged that a fairly constant temperature can be maintained.

The seeds are placed in trays, between moist blotting papers and kept in the incubator which is closed up in order to produce a moist atmosphere, until germination is complete. The best temperature for germinating most seeds is between 80° and 90° F.

Home Made Germinator.

One of the simplest and most practical germinators can

be made by taking two common dinner plates, and placing in the bottom of one, two or three layers of filter paper or other absorbent and thoroughly wetting it. Place the seeds to be tested on top of this. If the seeds are large as corn or wheat you may cover them with blotting paper or a cloth, though this is not necessary. Small seeds, such as clover or grass, do better if not covered.

Now invert the second plate over the first, being careful that the edges touch evenly. This makes a moist chamber, and gives the most favorable conditions for germination.

Similar moist chambers may be fixed up by using any shallow bucket or pan having a cover, or tin or wooden boxes may be used such as tobacco and cigar boxes, all of which when used properly will give satisfactory results.

DERMINATION OF WEIGHT PER BUSHEL

Grain testers are usually made in three sizes, pint, quart and two quart. When the measure is properly filled with grain and hung on the balance, the number of pounds the grain will weigh per bushel can be directly read.

The greatest care must be exercised in filling the measure. The grain should not be shaken or pressed down but allowed to fall as loosely as possible into the tester. Do not dip the grain up with the measure, but take the measure in both hands and force it bottom down until the top is level with the grain, then scoop the grain in with the hands, allowing it to fall as loosely as possible. Then being careful not to press or shake down the grain, stroke the top with a straight edge, and hang on the balance.

A little practice will enable one to do fairly accurate work with the tester.

Practice work with tester.

Try taking duplicate samples until you can get the same results every time.

Fill the sampler in various ways such as dipping it into

the grain, or shaking and pressing the grain down a little after the tester is filled, and compare weights with those obtained when tester is properly filled.

TEST FOR MOISTURE IN GRAIN

Use samples of corn of various grades, and kept under different conditions, such as corn too wet to grade, corn kept in open crib since husking, corn kept in dry seed room, etc. Also use samples of oats, wheat and barley.

Sampling: After mixing up your sample carefully, take about two ounces and grind in a fine coffee mill, running it through several times, reducing as fine as possible. Then take a 1 gram sample and dry in water oven to constant weight. The per cent of moisture is found by dividing the difference between weight of original sample and dry sample, by weight of dry sample.

TABLE OF GRAIN WEIGHTS PER BUSHEL

LBS. PER BU.	LBS. PER BU.		
Alfalfa	60	Kentucky Blue Grass...14	
Alsike	60	Meadow Foxtail	7
Barley	48	Meadow Fescue	14
Beans, all	60	Meadow Grass, Rough	
Buckwheat	52	Stalked	14
Broom Corn	46	Millet	50
Brome Grass	14	Oats	32
Blue Grass, Kentucky...14		Orchard Grass	14
Blue Grass, English...14		Pearl Millet	56
Cane	50	Peas, Field or smooth	
Clover, Alsike	60	garden	60
Clover, Red	60	Peas, wrinkled	56
Clover, White Dutch...60		Peanuts	24
Corn	56	Pencilaria	56
Corn, on ear.....70		Potatoes, Irish, good	
Cow Peas	60	measure	60
Creeping Bent Grass...20		Potatoes, sweet	50
Crested Dogtail	21	Rape	60
English Blue Grass...14		Red Top	14
English Rye Grass...14		Red Clover	60
Emmer	40	Rye	56
Fescue, Hard	14	Rye Grass, English...24	
Fescue, Sheep	14	Rye Grass, Italian...24	
Flax	56	Speltz or Emmer.....40	
Hemp	44	Sweet Vernal	10
Hungarian Millet	48	Timothy	45
Japanese Millet	40	Vetches or Tares.....60	
Johnson Grass	25	Wheat	60
Kaffir Corn	50	White Clover	60

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