

THE KINDS AND CLASSES OF CEREAL GRAINS GROWN IN THE U. S. AND
METHODS OF MARKETING SAME WITH SPECIAL REFERENCE
TO GRADING COMMERCIALY.

BY

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A cereal is any true grass that is grown for its edible seeds. There are six leading cereals in the United States which are given in the order of the area grown of each, as follows:-- Maize, Wheat, Oats, Barley, Rye and Rice. Buckwheat and Kafir corn are sometimes called cereals. Kafir corn belongs to the grass family and is grown for its edible seeds but the buckwheat would not naturally come under the class of cereals because it is not a grass but belongs to the mustard family.

The cereal grains have through all ages occupied a prominent place in the dietary of man and as food for domestic animals. These crops occupy the bulk of the cultivated area of the United States and are entitled to the greater part of man's attention both for their growing and improvement and for their care, grading, marketing and storing after they are produced.

Every cereal has undergone a great change in its productivity and grade of grain in the last decade. The change is the result of two forces -- environment and heredity. It has been proven that the principles of breeding which apply to animals apply as well to the plants and cereals, and since this is true it is possible to produce a corn with one more kernel to the ear or a wheat with one more kernel to the spike, and if this can be done it is possible to greatly increase the yield of the annual crop. However, the breeding of plants is harder to control than the breeding of animals because, 1st, Selections are made from Embryos (Seeds) and not of mature plants; 2nd, it is difficult to control pollen or male plant. Sex of plants was not known until 1691. With animals all this is easily overcome. In cereals it is difficult to tell the parents of the seed while in the animals the parents are

known.

I will now take up a discussion of the cereals in their order beginning with wheat, touching upon the more important points.

Wheat is botanically known as *Triticum sativa*. The members of the botanical group of wheat are light in number and are as follows: *Triticum Sativa Vulgara*, common wheat; *Triticum Sativa Compactum*, Club head wheat; *Triticum Sativa Lurgidum*, Poulard Wheat; *Triticum Sativa Durum*, Durum wheat; *Triticum poluncium*, Polish wheat; *Triticum Sativa Dicocum*, Emmer; *Triticum Sativa Spelta*, Spelts. The common wheat first named is the type most generally grown.

The emkorn, emmer and spelts are not grown very extensively in the United States but the common, club, and durum wheats are grown quite extensively; the other types are only grown experimentally in this country.

When the seed germinates it sends out a whorl of temporary roots. The coronal or permanent roots are thrown out from the lower nodes; they contain no tap roots but the side roots have been known to reach a depth of seven feet. The length, color, habit and thickness of the culm varies with the variety. The leaves vary in length, and the sheath clasps the stem as in all grasses. Buds form in the axis of the leaves from which roots or culms may be formed upon coming in contact with the earth. Each culm may produce a limited number of culms; consequently several dozen culms may be produced from one seed.

Each spikelet may mature from two to five kernels. They are connected with the spike by means of a rachilla and are alternate on either side of the stem. A spike averages from three to four and a half inches in length and contains from thirty to fifty grains. The

yield depends upon the number of spikes to a given area, the number of grains in a spike and the weight of the grain.

The wheat grain is divided into four parts -- embryo, aleurone layer, endosperm, and bran. The endosperm is the part used in making flour. The aleurone layer and embryo is rejected along with the seed covering or bran.

The date of harvesting varies with the locality. In the humid regions the wheat is cut as soon as the straw begins to turn yellow and the grain to harden, while in the arid regions the crop may stand as long as nine weeks after it is ready to cut. In the first named region the wheat is threshed from the shock or is stacked and then threshed after going through the sweat, while in the latter region it is usually cut and threshed all in one operation. The grain is either stored on the farm or is hauled to elevators and stored until the owner is ready to sell it. A certain price is charged for the storing of wheat in these elevators.

The cold and exposure will not effect the wheat and will prevent damage by insect; the larger the bulk the less surface exposed and the less liability of the insect pests. Air spaces should not be made between the bins or in the walls of the granary as this provides hiding places for mice and rats. A single wall and great care, especially if insect pests of grain are liable to be prevalent, should be exercised in storing the crop.

The markets of the country recognize four distinct types of wheat as grown in distinct localities. These are the soft winter wheat in the eastern United States where the climate is mild and moist; the hard winter wheat south of Minnesota and the Dakotas, between the Mississippi River and the Rocky Mountains where they have the extremes of temperature and moisture; the hard spring wheat in Minnesota, Dakotas, Wisconsin, Iowa and Nebraska and the white in the

Pacific Coast and Rocky Mountain States.

The United States exports a large percent of the wheat crop raised each year. According to the agricultural statistics of the United States for 1905 the total wheat crop was 692,979,000 bushels. The exports were 34,973,291 bushels of wheat, 13,919,048 barrels of flour or 97,609,007 bushels of wheat and flour both. The Chicago price for the same year averages 87 cents per bushel.

The United States sends most of her wheat to the countries of Europe as there is where all of the countries are situated that consume more wheat than they produce.

Every large market maintains a system of inspection of wheat for which a certain charge is made. It is inspected when it arrives in and when it leaves the market.

The points to be observed in grading wheat are; The hardness of wheat. This varies in different localities due to the abundance or lack of rainfall. In a locality where rainfall is plentiful the wheat is generally soft and of a lighter color and lower in protein than that grown in the arid localities. The wheat grown in the eastern half of the United States is soft while that grown in the western half is of the hard red type, but the characteristics which mark them as hard winter wheats are due to environments, for when grown east of the Mississippi River they become soft. The northern wheats are harder than the southern.

The texture is described as horny layer and starchy layer and is judged by making cross sections of the grain. When it is dark and vitreous it is horny and when it is white it is starchy. The white is the characteristic of soft wheat while the horny is the characteristic of all hard wheats and an indication of high protein and

stronger flour.

A good wheat never has a low weight per bushel while a poor wheat never has a high weight. The weight is therefore of greatest importance in judging the quality of wheat.

Number 1 and 2 wheat should have no sprouted decayed grains. Number 2 may have a few discolored grains. No. 3 may have a few sprouted grains if it is otherwise in good condition. The grading is based upon the actual milling quality of the grain.

Mustiness is caused by a dampness in the stack or bin and such wheat is worthless for flour but it is often worked into some form of stock food.

Wheat varies from nearly a brick red to nearly a white. Those from mild climates are light, while the wheat from colder and dry climates is darker. Yellow berries in hard red wheat depreciates its value. The dark and burnt appearance is caused by stack burning, and the exposure to weather causes a dull appearance, and overheating in bins a whitish appearance and a musty smell.

The following are the rules adopted by the board of Railroad and Warehouse Commission for the inspection of grain in Chicago.

Red Winter Wheat.

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 cleaned.

No. 3 Red winter wheat shall include red winter wheat not clean and plump enough for No. 2 but weighing not less than 54 pounds to the measured bushel.

No. 4 Red winter wheat shall include red winter wheat, damp,

musty, or for any cause so badly damaged as to render it unfit for No. 3.

Red winter wheat containing a mixture exceeding five percent of white 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 quality thereof and classed as white winter wheat.

Hard Winter Wheat.

The grades 1, 2, 3, and 4 of hard winter wheat shall correspond in all respects with the grades 1, 2, 3, and 4 Red winter wheat except they shall be of a Turkish variety.

In case of a 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 fifty 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 five 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 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 five 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 No. 2 and 3 Red Winter wheats, except they shall include mixtures of spring and winter wheats.

In examining and grading grain it is well to examine for each point separately. The test of purity is made by separating the impurities from the pure and calculating the percent. The test for viability is by running a germination test to determine the percentage of seeds that sprout.

Maize, the second cereal I take up, belongs to the grass family Gramineae of the genus *Zea* and to the tribe Maydeae. It is distinctly an American plant not being known outside of America until introduced from America. When America was discovered the Indians were found growing maize. (At that time all cereals were called corn, therefore maize was called Indian corn to distinguish it from other cereals.) In the same tribe with maize belongs the other plants, teosinte (*Euchlaena mexicana*) and gama grass (*Tripsacum doalyloides*) only used as fodder. The wild prototype of *Zea* has never been identified. So far only the one species which includes the cultivated has been discovered. There are six distinct types considered as having come from

the one specie, which are as follows:

Pod Maize	(Zea tunicata)
Pop "	(Zea everta)
Flint "	(Zea indurata)
Dent "	(Zea indentata)
Soft "	(Zea amyloea)
Sweet "	(Zea saccharata)

In the pod maize each kernel is encased in a husk, seldom grown even as a curiosity.

Pop maize has a hard glossy kernel which on being heated will explode and turn the outside hull inside and leave a large fluffy white and palatable mass. This exploding or popping is supposed to be due to the close compaction of the starch globules to the endosperm. It is grown for human consumption and is largely used when popped.

Flint maize grain split shows a glossy endosperm around a white portion. It is largely grown in the north where the seasons are too short for the dent variety.

Dent maize grain when split shows the embryo with a glossy ^{running} portion on each side and the white portion ~~round~~ to the top of the kernel. It is indented on the top due to the shrinking of the central portion of the grain. Contains deep kernels. Ears of large diameter and good length and contains a larger percent of grain to cob of any type of maize.

The dent and flint maize furnish all the commercial grain of maize.

In soft maize the endosperm is entirely white, otherwise its appearance is the same as flint maize, but it is not grown commercially in the United States.

Sweet Maize has a horny translucent endosperm. The kernels are broad-wedge shaped and well wrinkled on the surface. It grows usually a short stalk with a large number of ears to the stalk. The ears are not large, are used for cooking and eating by man, while they are in the milk stage. It is grown wxtensively for the purpose of canning, while in the milk stage, for human food.

The maize plant like the wheat has no tap root, but unlike the wheat the *roots* fill the surface of the soil for a large distance with fine roots which run horizontally from to two and a half feet then turn downward. It contains true roots and brace roots. The true roots start from nodes about two inches below the surface of the earth while the brace roots start as much above.

The culm of the maize is reported as varying in height from eighteen inches to twenty two feet. However, the average is from four to twelve feet. It may vary with variety, also soil and climate. The culms unlike most grasses are filled with soft pith.

Buds are in the axis of leaves which under certain conditions may develop into branches which are termed as suckers. It has been calculated that an ordinary stalk with twelve leaves would have twenty-four square feet of leaf surface.

Unlike the wheat this staminate flower is borne on a pannicle at the top of the plant while the carpellate is borne in the axis of the leaf forming ear. This distinguishes it from all other cereals.

The ears vary in length and in the number of rows to the ear, from four to twlve inches in length and eight to twenty eight rows. The rows develop into distinct pairs so regular that seldom if ever an ear is found with an odd number of rows. The rachi of the kernels grow together thus forming the cob. Ordinarily, dent maize grows only

one ear per stalk, although more than that has been grown. No variety has been bred that will grow a uniform number of ears to every stalk.

The maize kernel has the same general structure as the wheat kernel. The size, shape and weight, however, are widely different from that of any other cereal.

In harvesting maize the ears are usually husked by hand, the machinery for husking having not met with success. Usually one man takes a wagon and team, gathers ^{the ears} from the stalks and stores them in slat cribs. Some times the slats are cut and the corn husked and shredded and occasionally when it is used for fattening steers it is fed in the fodder.

When the corn is gathered it usually contains so much moisture that storing of shelled corn in close bins would cause it to sweat and mold. Therefore it is usually stored in slat bins in the ear so that the moisture may evaporate. When it becomes dry enough it is either shelled and hauled to elevators and sold or stored or it is hauled to elevators in the ear and shelled there.

The maize inspection recognizes three classes of grain with three grades as follows:

Yellow Maize, Nos. 1, 2, and 3.

White Maize, Nos. 1, 2, and 3.

Maize, Nos. 1, 2, 3 and 4.

The legal weight per bushel is fifty six pounds of shelled corn and seventy pounds of ear corn, while at certain times of the year it is eighty pounds, i. e. before the grain is fully air dry .

Of all the land in the United States in cereals one half is maize. The crop of 1905 was "2,707,994,000 bushels", that of the world including the United States "3,455,034,000 bushels" or the crop

excluding the United States was 747,040,000 bushels, the United States producing 1,960,954,000 bushels more than all the rest of the world.

The United States acreage of Maize was "94,011,369 acres" with an average of 22.8 bushels" per acre with an average farm price of 41.2 cents and the Chicago price 40 to 50 cents per bushel.

The total amount of maize exported for the five years from 1898 to 1902 was 160,000,000 bushels, while in 1905 for the one year the amount was 119,893,833 bushels. The amount of maize exported by the United States would be very much greater were it not for the fact that maize when it leaves the market here is graded as No. 1 Maize, may be the time it crosses the ocean have become so musty and damp that it will not in some cases, be worthy of a grade. But this is being eliminated to a certain extent by not allowing the maize to be shipped with more than a certain percent of moisture. With maize as with wheat soundness, plumpness, and mixture of foreign substance and difference of color fixes the grade. The weight per measured bushel does not enter into the determination of the grade.

The special points to be observed are color, soundness and moisture.

Nos. 2 and 3 may vary 10 to 25 per cent in color.

Good maize should be cleaned, reasonably free from decayed and cracked kernels or any considerable percent of shrunken or chaffy kernels.

Wet or heating condition can not be graded.

Oats, the third most important cereal, belongs to the tribe *Avenae Stativa*. It differs from wheat in that the grain is borne on a spreading pannicle instead of a spike. There are but a few economic plants grown that belong to this tribe. The oats may be divided into

spring and fall varieties, the spring varieties being grown farther north while the fall varieties are more of a southern crop.

The improvement of oats may be carried on much the same as that of any other cereal by selection and breeding.

The plant in general with the exception of the pannicle is similar to that of the wheat. The pannicle is from nine to twelve inches long with from three to five whorls of branches arising from alternate sides of the rachis.

The kernels are, except in hullless varieties, incased in the flowering glume and palea. The oats kernel is a little more elongated than the wheat; otherwise it is similar.

The oat grain varies widely in composition, due probably to the varying amount of hull. It is composed of same parts as that of wheat.

For the best results both in grain and in straw it should be cut when one-half of the leaves are green and the grain is in the dough stage, and then be slowly cured in round shocks, unless weeds are present, when fast curing is required; this is best done in long shocks. Harvested in this way the chemical composition, quality and yield of grain is not affected. The rest of the harvesting and threshing is similar to that of wheat.

The following classes and grades have been recognized by the Illinois Board of Railroad and Warehouse Commission and is pretty generally accepted:

White Nos. 1, 2, 3, and 4.

White Clipped Nos. 1, 2, and 3.

Oats, Nos. 1, 2, 3, and 4.

The total oats crop for 1905 was 953,216,000 bushels, standing second of the cereals of the United States in bushels and third in

acreage and value. The average yield per acre for the same year was 34 bushels and the average farm price 29.1 cents. The total exports including oatmeal was 48,434,541 bushels while we imported 40,025 bushels. The total value of the oats crop of the United States was \$277,047,537.

The weight per bushel of measured oats in nearly all of the states is 32 pounds, but it may vary from 20 to 50 pounds, the lighter oats being in the south. In growing commercially the mustiness and purity of the grain must be observed carefully; an occasional grain of wheat is not so objectionable as is weeds and stems. Plumpness, soundness and weight are important factors. The following rules for grading are taken from the Chicago Warehouse Commission.

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 or 32 pounds.

No. 3 White Oats shall be seven-eighths white but not sufficiently sound and clean for No. 2; weight 27 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 seven-eighths white, sound, clean, reasonably free from other grain and shall weigh not less than 36 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 34 pounds to the measured bushel.

No. 3 White Clipped Oats shall be seven-eighths white, not

sufficiently sound or clean for No. 2 and shall weigh not less than 28 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 not fit for No. 3.

In testing for purity a sample is taken and all impurities separated from it; the pure and impure are then weighed and the percentage of purity calculated.

The fourth cereal to be considered is barley. It with rye belongs to the same tribe with wheat, but barley differs from wheat and rye in that the spikelet has but one flower and more than one spikelet at each joint of the rachis. There are three species of the barley: the six-rowed (*Harden Sativum hexadoctes*); the two-rowed (*Harden Sativum distoichon*), and the hulless (*Harden Sativum L*). The two-rowed variety is a spring cereal, the six-rowed is a winter and the hulless is spring.

Aside from the spike the plant is very similar to the wheat plant.

The grain like that of the oats is encased in the flowering glume and palea, except hulless varieties; the kernels resemble the wheat some, tho differing in size.

The endosperm varies from a mealy white to a glassy or vitreous. The grain is more carbonaceous than wheat or oats; also more

crude fiber than wheat and less than oats; otherwise it is very similar to wheat.

If barley is allowed to fully ripen standing it will have a more mealy endosperm but it is more subject to danger of discoloration from rain and dews. The color is important in fixing the commercial grade; therefore, early cutting is generally practiced, which, if promptly shocked and capped both may be obtained. Otherwise it is similar to that of wheat. Care must be exercised in the threshing so that no kernels are broken. Broken grains not only are worthless but they injure the malting quality of the barley by causing a mold. Therefore, great care is required in setting the concaves.

The Chicago market recognizes the following classes and grades of barley:

Barley Nos. 1, 2, 3, 4, and 5.

Scotch Barley Nos. 1, 2, and 3.

Bay Brewery Barley Nos. 1, 2, and 3.

Chevalies Barley Nos. 1, 2, and 3.

In 1905 the United States had an acreage of 5,095,528 acres in barley, that averaged 26.8 bushels per acre, making 136,651,000 bushels at an average price of 40.3 cents per bushel, making a total value of \$55,047,166. The crop is marketed chiefly for brewing, the lower grades being used as food for domestic animals. The imports and exports are low, not over ten to fifteen percent of the crop.

The most important points to be observed in grading barley is the color, texture and brewing quality. The color should be light with no tint of yellow or brown. Texture varies from white and starchy to vitreous in appearance, the former containing the lower percentage of protein which the brewers like and is considered strongly

in brewing quality. The following are rules for inspection as adopted by the Chicago market:

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 damaged or for any other reason is unfit for malting purposes, except that barley which has been chemically treated shall not be graded at all.

Other classes shall be graded as barley except that it shall be of the variety named.

Rye, (*Secale Cereale* 6) as has been noted, is of the same tribe as wheat. It is more nearly like wheat than any other cereal. The varieties of rye are few due to its easily cross-fertilizing.

The rye plant sends out a whorl of four instead of three temporary roots, which probably accounts for its greater hardiness. The spike is somewhat different from wheat, being longer, and there is a difference in the glumes being awl shaped instead of boat shaped. The kernel is rather longer and more wrinkled than the wheat kernel. The general structure is similar to the wheat grain.

Rye is harvested very similar to other small grains. The straw being so long in some cases as to seriously tax the capacity of the binders. Special machines have been devised for threshing as the

straight straw is more valuable than tangled, and in some cases they have an attachment for binding the straight straw. The grain is used for flour, for food for domestic animals and for alcoholic beverages.

The crop of the United States for 1905 was 28,486,000 bushels from 1,730,159 acres with an average yield of 16.5 bushels at 61.1 cents per bushel, at a total value of \$17,414,138. Probably one-fourth the total production in export; no importation.

Only one commercial grade is recognized. The Illinois rules for grading this class are

No. 1 Rye shall be sound, plump, and well cleaned.

No. 2 Rye shall be sound, reasonably clean and reasonably free from other grain.

No. 3 Rye shall be reasonably sound, reasonably dry, free from other must, and not good enough for No. 2.

No. 4 Rye. All Rye damp, musty, or for any reason not fit for No. 3.

Rice (*Oryza Sativa* L) belongs to tribe *Oryzae*. There are two species of wild rice, *Zizania aquatica* L and *Zizania Milicea* M). From the fact that rice is not a very extensive crop of the United States I shall not attempt to give any description of it but shall only mention a few points in production and marketing.

The United States produced 411,400,000 pounds valued at \$16,121,298 and imported 166,547, 957 pounds during the year 1895.

The weight of a bushel of paddy or rough rice is 45 pounds. Paddy is usually put in barrels or sack and quotations are made accordingly. Milled rice is usually quoted by the pound.

The following grades are recognized by the New Orleans Board of Trade: extra fancy, fancy head, choice head, prime head, good head, fair head, ordinary, screenings, common, inferior, No. 2. All grades between extra fancy and fair are for whole grains or for head rice;

those between ordinary and inferior include broken grains, while No. 2 contains fine particles.

Kafir corn is not grown much as a cereal, being but sparingly used for human food, but quite extensively as food for domestic animals. It is of recent introduction and there is not much to be said about it, but the production is rapidly increasing.

Buckwheat is not by definition a cereal, but it is grown and used as a cereal, the seed being used as human food and is of some economic value. A total of 14,585,082 bushels were produced in 1905 valued at \$8,565,499, of which 316,399 bushels were exported, but practically none was imported. I have been unable to find anything about grading buckwheat commercially.

In grading grain commercially one of the main points in fixing the grade is the moisture content. This until quite recently has been a rather difficult matter, but by a method described by Bulletin No. 99 of Bureau of Plant Industry in which the grain that is to be tested and graded is weighed and the whole grain heated in oil to a temperature a considerable above that of boiling water and the water driven off, condensed, measured and the percentage of water can be determined in from twenty to twenty five minutes. The mixture of grain and oil is heated until the thermometer registers 190°C. The heat is then turned off and allowed to cool which will usually be from 20 to 25 depending upon the amount of water.

The oil used must be free of water, and of a low viscosity, and of a high flashing point to avoid danger of explosion. Its saponification must be zero and it must be cheap.

The samples should represent the entire lot of grain under consideration. This of course holds true for all inspection of grain. The number of samples taken from the bulk will depend upon the

quantity and quality. Samples taken for moisture test should be put in air tight retainers to prevent any drying of the grains; otherwise a fair test will not be had. About 100 grams of grain is the most convenient to use. An ordinary torsion balance such as could be had for \$15.00 will serve every purpose. The amount of oil to be used may vary; all that is required is enough that all the grain is covered.

The grain need not be ground -- in fact it is better not ground -- for grinding causes a loss of moisture amounting to some cases to 1.5 per cent. The oil can be nearly all recovered and used a second time. This was first used with one distillation flask and this method compared with the old or oven method where the samples were subject to 110° heat for from 96 to 124 hours and the average difference was 0.14 per cent. The difference is in favor of the quick method for in the oven method all the water cannot be driven off. With the quick method and the apparatus described in Bulletin 99 a percentage of moisture system of grading is easily within the possibilities of grain inspection.