

A CLASSIFICATION FOR INHERED
LINES OF CORN

by

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INTRODUCTION

Corn constitutes a very important part of American and, to a lesser extent, foreign agriculture. Hybrid corn is rapidly replacing the older grown varieties in most sections where corn is produced in any quantity. There are numerous kinds of hybrids. The inbred lines of corn that go to make up these combinations are also numerous. At the time of this study, there was no published classification for these many and diverse inbred lines. Such a classification would have much practical value.

At the present time, there is considerable secrecy between the different producers in regard to the pedigrees of certain hybrid combinations. A classification and complete description of a line would allow the line to be identified. This would remove the need for secrecy; because then, any person or persons who produced and sold the seed of an inbred line without the permission of the person who made the identification could be prosecuted.

The hybrid seed corn inspectors would have a definite means of checking on a combination. A producer would not be able to mislabel the double cross combination and sell it under a different hybrid number. Such a method for detection is not now available. Therefore, this misrepresentation may or may not be committed at the present time. Undoubtedly, this has been done in the past and will be in the future. A key would aid in discovering such acts.

Another purpose afforded by such a key is the standardization of line nomenclature. At present some lines have several different designations. Each station previously had a different system of naming lines; some used numbers, some letters, and others a combination of letters and numbers. Recently there has been a trend toward standardization and simplification of line nomencla-

ture. The experiment stations of some of the corn growing states have been given a certain letter to precede the number that is ascribed to that line. Each state has a different letter in order to avoid confusion. The letter is the first letter in the state's name, except in those cases where two or more states have names that begin with the same letter. In such cases another letter has been assigned to that state.

Therefore, in view of the situation in hybrid corn production, it was considered desirable to devise a system of classification and identification of inbred lines of corn.

MATERIALS AND METHODS

Thirty-three inbred lines were used in this study. Most of these lines are used in the commercial production of hybrid corn. They represent some of the more important lines used in the breeding programs of the corn belt states.

The data were taken from two replications located in the center of a yield test plot. In addition to this, 23 of these lines were grown in an irrigated nursery. The data from the field planting were checked with these lines grown in the nursery under irrigation.

Each plot of the replication was six hills by one hill with three plants per hill. However, the stands were very poor for several of the entries. The material for this study was planted at the normal corn planting time for this area. No ears were produced on most of the entries under field conditions. The kernel and ear characters were taken from ears grown in the irrigated nursery and from the seed samples that were used for planting.

These data are the mean or average of all of the plants in the planting and not from a single plant or plant part. The measurements and gradings or rankings of the plants of each line varied little for most of the characters

recorded. Certain grades or classes were set up for several of the characters. These grades were the two extremes of any one character and the middle class. For other characters, definite measurements were taken in centimeters or in millimeters.

REVIEW OF LITERATURE

Various authors (Hitchcock, 1935; Robbins, 1931; Weatherwax, 1923 and Leonard, 1933, 1937) have given botanical descriptions of the corn plant. The following description does not include all of the variations and anomalies that may occur in corn but it is the description of the "normal" corn plant. The following is taken from the works of the above mentioned authors.

THE CORN PLANT

Corn or maize is placed in the tribe Tripsacene and the grass family Gramineae. Zea is a monoecious genus, i.e., the male and female flowers are borne in separate places on the same plant. The kernels are borne on the terminal end of a lateral branch, the cob. It is an annual varying from 2 to 11 months in the time required to mature and from 1 to 26 feet in height.

Culm

The long jointed culm is composed of a solid pith through which run the vascular bundles. The stalk or culm is terminated by the staminate inflorescence, the tassel. The lateral branches of the culm are terminated by the pistillate inflorescence, the ear. The basal branches are the tillers or suckers and arise from the lower nodes. The upper internodes are straight and nearly cylindrical. The lower internodes are furrowed on the side next to the leaf blade.

Root

Maize has a fibrous root system. The number of temporary roots does not seem to be constant for each of the groups or subspecies of corn. Robbins (1931) says there are four temporary roots in dent and pop corn, one in flint and sweet corn, and varying numbers in the soft corns. The roots of corn arise in whorls, which vary in number from two to ten, one whorl above another. The internodes between the whorls are very short. Robbins calls this entire group of whorls the "root crown". There are two kinds of roots: main vertical roots and main lateral roots. Vertical roots curve out slightly from the crown and go directly downward. The lateral roots curve downward at first and then extend horizontally for a distance and then again curve downward. In addition to these roots, there are the brace (aerial, prop or buttress) roots which arise from the nodes just above the ground.

Leaves

The leaves are alternately arranged on the culm. They vary from 8 for the very early varieties to 43 for the tropical varieties in the number of leaves. Weatherwax (1923) divides the leaf into three distinct parts: the sheath which surrounds and strengthens the meristematic part of the next higher internode; the blade or lamina, leaving the stem near the node next above the one to which it is attached; and the collar-like ligule, attached at the top of the sheath and closely surrounding the stem. The blade is long and relatively flat. The husks or spathes of the ear shoot are modified sheaths which occasionally have a modified blade.

Staminate Inflorescence

The staminate inflorescence or the tassel is a panicle composed of a central axis or spike and long, slender spike-like branches which are spirally arranged around the axis. In the central spike there are usually four to eleven rows of spikelets in pairs. Lateral or tassel branches usually have only two rows of spikelets in pairs. One spikelet of the pair is generally pedicellate, the other generally sessile or nearly so. The staminate spikelet is a rounded, somewhat laterally compressed structure, which arises with its edges toward the rachis. The other parts of the spikelet are, previous to flowering, completely inclosed by two membranaceous, overlapping glumes. Robbins (1931) says there are seven to twelve nerves on the glumes, but this range can be extended from four to fifteen for the limits as shown by this study. The glumes are more or less pubescent while the lemma and palea generally are glabrous. The lemma is two to six nerved, and the palea is two nerved although one or both of them may be obscure. These bracts are hyaline and pointed or rounded at the tips. The rachilla upon which the upper floret is borne is very short. In the flower proper, the three stamens are about equally spaced around the somewhat triangular receptacle, one being dorsal and the other two next to the palea. The two fleshy and truncate lodicules are dorsally located, alternating with the stamens. In the middle of the receptacle is a rudimentary pistil. The upper floret matures first.

Pistillate Inflorescence

The pistillate inflorescence, the ear shoot, or the ear is borne in the axils of the leaves. Morphologically, the ear is a spike on whose thickened axis the spikelets are borne in pairs in several longitudinal rows as are the

staminate spikelets of the central spike. Each row of pairs of spikelets contributes, usually, two rows of kernels on the ear. Typically both spikelets in the pair are sessile, and the two are indistinguishable except in the early stages of development. Each spikelet has two florets; the lower one usually is abortive and the upper one fertile. The lemma and palea of the abortive flower remain and form part of the chaff on the cob. The spikelet is subtended by two glumes that are generally shorter than the ovary. They are very broad and fleshy at the base, thin membranous above and fringed on the edges. The lemma and palea of the fertile flower are short, broad and membranous. The single ovary bears one long style which is forked at the tip. The corn silk is considered to be a compound stigma, because it is receptive to pollen a good portion of its length, if not all of the way. Three small rudimentary stamens have been observed in the fertile floret, but the lodicules are missing. The lodicules, the rudimentary stamens, and the rudimentary pistil are present in the sterile floret.

CLASSIFICATION OF GENUS ZEA MAYS

Corn belongs to the grass family, Gramineae (Poaceae) and the tribe Tripsacaceae in which the spikelets are unisexual; the staminate usually in pairs, 2-flowered; the pistillate in pairs, 2-flowered. The hundreds of inbred lines and the numerous varieties of corn are included under the one species Zea mays L. This species is divided into "species groups" or subspecies. The most important of these are:

1. Zea mays tunicata - pod corn.
2. " " evecta - pop corn.
3. " " indurata - flint corn.
4. " " indentata - dent corn.

5. Zea mays amylacea - soft corn.
6. " " saccharata - sweet corn.
7. " " amylacea-saccharata - starchy-sweet corn.
8. " " ceratina - waxy corn.

Some minor subspecies are:

1. Zea mays ramosa - a type of corn with highly branching tassel and branching ears.
2. Zea mays canina Watson - Maiz de Coyote, a branching plant producing small ears on lateral branches. It has been produced artificially by crossing corn and teosinte. It is said to grow wild in Mexico at the present time.
3. Zea mays japonica - an ornamental sort with small flinty grains.
4. Zea mays hirta - a hairy South American corn.
5. Zea mays curagua - a form with serrate leaves.

The seven most important subspecies of this species possesses the following distinguishing characteristics. This key is adapted from Robbins (1931).

Key to Subspecies of Corn

- 1a. Each kernel inclosed in husks (glumes, lemma, palea); the ear is also inclosed in husks; a rare form, considered by some to be the primitive type, Zea tunicata (pod corn).
- 1b. Each kernel naked, not inclosed in pod or husk:
 - 2a. Grains with popping properties; popping is due to the turning inside out of the kernel through the explosion of the contained moisture when heat is applied; pericarp is thick and tough; excessive proportion of horny (corneous) endosperm; kernels and ears small, Zea everta (popcorn).

2b. Grains without popping properties.

3a. No corneous endosperm, hence grains are soft; shaped like flint corn; no indentation; the mummy corns of Peru, Mexico, and southern United States probably belong to this group, Zea amyloacea (soft corn).

3b. Corneous endosperm present.

4a. Grains more or less wrinkled or shriveled; kernels horny and translucent in appearance.

Grains horny throughout, Zea saccharata (sweet corn).

Grains with upper half horny and translucent, the lower half starchy, Zea amyloacea-saccharata (starchy-sweet corn).

4b. Grains not wrinkled, smooth.

Starchy endosperm extending to top of kernel; corneous endosperm at sides; shrinkage of starchy endosperm at top of grain causes a drawing in of pericarp and hence the characteristic dent is formed, Zea indentata (dent corn).

Starchy endosperm inclosed by the corneous endosperm; hence there is no shrinkage of top of grain and no dent formed, Zea indurata (flint corn).

RESULTS AND DISCUSSION

TAXONOMIC DIFFERENCES

Characters from seven parts of the plant are included in this study. These are: culm, leaf, tassel, silk, ear, kernel and general plant characters. Each of these was subdivided into several groupings. The material used in the following discussion represents some of the contrasting characters found in inbred lines of corn. The genetics of most of these differences has not been worked out as yet.

Plant Characters

Germination. The lines were roughly divided into three groups, early, mid-early and late, as to the length of time from planting until the appearance of the plumule. The early group germinated in about 21 to 24 days after planting. The mid-early group germinated in 25 to 30 days. All the lines that germinated later than this were put in the late group. The number of days given here are for a definite year in a definite locality. The number of days to germination will depend on general environmental conditions and the vitality of the seed as well as genetic difference, but, the relative order should remain the same.

Vigor. Inbred lines of corn differ considerably in vigor during the seedling and young plant stage. In this classification study, they are described as very vigorous, vigorous, and not vigorous or weak. This character is influenced by the time of germination but there are wide differences between some lines which germinate at approximately the same time. The notes on this character as well as the notes on those characters used for the vegetative key were taken approximately four weeks after most of the lines had germinated.

It should be remembered, however, that this grouping is relative for these lines.

Maturity. The relative dates on which lines shed pollen and silk, when planted at the normal planting time for corn, are useful in distinguishing inbred lines of corn. The relative order of maturity is indicated by dividing the lines into three groups: early, midseason, and late. The time of pollen shedding and especially silking is dependent upon the general growing conditions and time of seeding as well as differences in genic make-up. More than usual caution must therefore be exercised in making use of this character.

Height. The height of the plant is the distance from the surface of the ground to the tip of the tassel. These inbred lines have been grouped into three classes as to plant height: short, midtall, and tall. This character is especially useful in the identification of some lines in the field. This character is influenced by general environmental, seasonal and edaphic conditions, and the time of planting. This grouping is given as a class rather than a definite distance.

Other characteristics. At the Second Corn Improvement Conference held at the University of Wisconsin, Madison, Wisconsin in September, 1938, several characteristics were given for a number of lines. These included such things as disease resistance, insect resistance, lodging resistance, pollen shedding, ease of detasseling, quality of grain, ability to transmit desirable characters to hybrids and any of several others that make a line desirable from an economic standpoint.

These features were not used in the construction of the keys. They were included in the descriptions of the lines. The above mentioned characteristics were not recorded for all of the lines and not as completely for some as for others.

Culm Characters

Color. The exposed portion of the culms ranges from green to red in color. Severe conditions, as drought, insect damage, and other mechanical damage, accentuate the red color. The culms are divided into four groups as to color: green, reddish green, red, and dark red. The unexposed portion of the culm is some shade of green and is not included under the character given as culm color.

Size. The size of the culm is a distinguishing characteristic in some cases. Three classes, small, midlarge, and large, compose the grouping for this character. This grouping is relative and it refers to the average diameter of the internodes. This means that a certain number of inbreds have smaller culms than another group of inbred lines. It does not mean that the diameter of the culm is a certain number of centimeters.

Internode length. Three classes compose the different internode lengths: short, midlong and long. This grouping is relative and is a distinguishing character in some lines. The internode length refers to the average length between any two adjacent nodes.

Nodes. Prominence. The diameter of the node with regard to the diameter of the culm varies in the different lines of corn. This character is divided into three classes: prominent, not prominent and recessed or about the same size as the internode. The middle group, nodes not prominent, comprise the greater percentage of lines. In this group the diameter of the node is larger than the culm but not conspicuously so. In some lines the nodes are conspicuously larger than the culm; the number of lines in this group is rather small. In other lines, the diameter of the node is no larger and sometimes smaller than the diameter of the internode and thus presenting somewhat of a telescope

effect.

Number. The range in the total number of nodes varies from 15 to 27. Most of the lines fall in the range between 18 and 25. This number includes the nodes below the ground as well as those above. The total number given in the descriptions is an average of several plants. The number of nodes above the ground varies from 10 to 16. This number includes all of the nodes that are wholly above the surface of the ground. The number of nodes below the ground ranges from 5 to 10. This character is rather difficult to take due to the closeness of the nodes in the area below the surface of the ground and to the adventitious roots which arise from these nodes. The number of nodes below ground is best determined by counting the rings or layers of adventitious roots arising in this area. The number of nodes is fairly constant for a line; the variations usually are not greater than one or two nodes.

Brace roots. The number of nodes above ground from which brace, (buttress, aerial or prop) roots arise is subject, somewhat, to environmental conditions. Some lines develop roots on the first three or four nodes above ground while others may fail to develop any brace roots. The character of these roots as to size and amount, may also be helpful in the identification of some lines.

Suckers. The amount of suckering or tillering is an important factor in the consideration of a good female parent for the single cross. Few or no suckers are desired because this facilitates detasseling. The amount of suckers or tillers ranges from none to many. Under normal corn growing conditions this feature is constant for some lines; for example, Os426 suckers rather profusely. This is characteristic of this line; suckers were evident even under extremely dry conditions.

Leaf Characters

Blade. Length. The length of the leaf blade is the distance from the collar to the tip. As this character is affected by environment, the lengths were divided into three relative groups: short, midlong, and long. With these lines, the average length of the leaves varied from 60 to 95 cm, with the largest group between 70 and 80 cm.

Width. The leaves are placed into three groups as to wideness: narrow, midwide and wide. The widths of the blades for these lines varied from 6 to 15 cm. Definite widths in centimeters are not as usable in a general key as relative widths due to the effects of environment. This is a distinguishing characteristic for some lines but is not used as a major point in the key.

Color. Chlorophyll grades range from 1 to 4. Grade 1 is very dark green; 2, dark green; 3, medium or midgreen; and 4, light green. For classification and description purposes, grades 1 and 2 are considered as dark green. In some lines the leaf color is characteristic and may prove useful for classification purposes.

Wrinkling. This character refers to the wrinkles that run crosswise in the blade. This character is not to be confused with the wrinkles or creases that run lengthwise of the blade.

The amount of wrinkling on the leaves is recorded in three classes: heavily wrinkled, wrinkled, and little or no wrinkling. In the plants that showed considerable wrinkling throughout, the leaf blades are classed as heavily wrinkled. The plants in which the leaf blades are not heavily wrinkled throughout but may be in part or are slightly wrinkled throughout or only in part are called wrinkled. Those plants in which no or at least no noticeable wrinkling of the leaves occurs are classed in the group, little or not wrinkled.

In most instances, the location of the wrinkling is given as well as the extent or amount of wrinkling.

Creasing lengthwise. This character refers to the creasing of the blade in a direction parallel to the length. The inbred lines are placed in one of the following groups with respect to this character: creased lengthwise, little or some creasing lengthwise and not creased lengthwise. The first group contains those lines in which the character is distinct and the creases are rather long, i.e., 25 cm to the total length of the leaf blade. The second group is composed of those lines in which the creases are short or at least not distinct. The third group is self-explanatory.

Rigidity. This character refers to stiffness of the extended leaf blade; whether it corresponds to a straight line or an arc. This is a distinguishing characteristic of a number of lines before, as well as after, tasselling. It is described as rigid, semirigid, and nonrigid (Fig. 1). Rigid blades are stiff and form an angle of approximately 180 degrees. Semirigid blades form a small arc and the tip of the blades is mostly above or on a level with the collar. Nonrigid blades form a larger arc; the tip is on a level below the collar and in some lines even below the base of the sheath.

Erectness of leaves. This character refers to the angle that the leaf blade makes with the culm. It appears to overlap somewhat with the rigidity of the blades, but there are several distinct variations from this. This character is classified into three parts: ascending, spreading, and drooping (Fig. 2). The lines in which the leaf blades make an angle of less than 25 degrees with the culm are classified as ascending; those in which the angle is 25 to 60 degrees are called spreading; and those in which the angle is greater than 60 are classified as drooping.



Fig. 1. Rigidity of leaves. These are the classes used in describing inbred lines of corn.

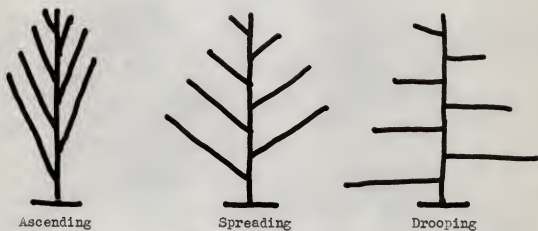


Fig. 2. Erectness of leaves. These are the classes used in describing inbred lines of corn.

Waviness. Due to the more rapid growth of the cells at the base and edges of the blade, the blade edges have a wavy appearance in some of the lines. Lines vary markedly in the amount of waviness. For purposes of classification, three relative groups, very wavy, wavy or midwavy, and not wavy, are described. Very wavy leaves have several waves along each margin. Wavy or midwavy leaves have few waves. Not wavy leaves do not have any waves in the margin; the edge is relatively even or straight.

Stripedness. Stripedness refers to the difference in chlorophyll color between the area adjacent to the vascular bundles in the leaf blade and to the area in the center of the vascular bundles. In most lines, this character may be evident in the younger blades and blade parts, but generally it tends to disappear with age. In other lines this character tends to remain distinct throughout the life of the plant. The relative stripedness of the blades of different lines is divided into three classes: distinctly striped, partly striped, and not striped. In the distinctly striped group, the striping is very noticeable and usually extends throughout most of the blade. In the second group, partly striped, the striping is confined to the lower and younger parts of the leaves and is not especially noticeable. In the last group, not striped, the blades are uniform in color throughout and no or very little appearance of striping is evident.

Pubescence. The pubescence of both the upper and lower leaf surfaces of the different lines differ very little from each other. The upper leaf surfaces are all pubescent, some to a greater degree than others. The lower leaf surfaces were glabrous for the lines studied. In another line not included in this work, the lower surface of the leaf was sparsely pubescent. The leaves of seedlings are glaucous, except for three lines (C1447, US1 and US3). The whitish, waxy bloom on some is heavier than on others. This note was not included

in the descriptions. The margins vary in pubescence, but they are all ciliate and becoming glabrate in the drier climates. This character could be used successfully in a vegetative key.

Ligule. The ligule varies from 2 to 7 mm in height. This measurement was taken at or near the mid-rib, at which place the ligule is the highest. This character appears to be the most constant of the leaf characters. These lines were separated into three groups in the vegetative key: (a) less than 5 mm high; (b) 3 to 4 mm high; and (c) more than 4 mm high. In the descriptions of the lines, the average length of the ligule is given in millimeters. The character and texture of the ligules of the different lines varied. These notes were not included in this study.

Collar. The pubescence of the collars of the different lines varies from pilose to glabrous. The pubescence was not confined strictly to the collar in most cases, but to the area immediately adjacent to the collar. This character is more noticeable on the collars above the sheath node. The data on this character were taken after the time of tasseling.

Sheath. The pubescence of the margins of the leaf sheath varied from villous to glabrous. The edges and margins of the older leaf sheaths become glabrate in dry climates. The character of pubescence on the rest of the sheath was not studied. No other sheath characteristics were recorded for all of the lines. However, some closed leaf sheaths near the top of the culm are recorded for some lines.

Tassel Characters

Tassel type. The tassels of the different inbred lines vary markedly in the angle at which the lateral branches arise from the peduncle. They vary also in the erectness and straightness of these branches. The b and c tassel types are overlapping in a number of cases while the a types are rather

distinct. These characters constitute major points of division in the key. Plate 1 illustrates the different tassel types, which are designated under the three general types. The following material was adapted from the work of Bryan, Jugenheimer, Eckhardt and Zuber (1937)^{1/}

1. Branches arising from a central spike at an angle of about 20 to 70 degrees making a rather loose open panicle.
 - a. Branches tending to remain straight or curve down slightly, and central spike erect.
 - b. Branches tending to curve over or droop considerably.
 - c. Branches and central spike drooping.
2. Branches arising at a sharp angle with central spike less than 20 degrees making a rather compact tassel.
 - a. Branches and central spike tending to remain straight and erect or nearly so.
 - b. Branches and central spike tending to droop over to one side with tassel remaining compact.
 - c. Branches and central spike drooping and curving over to one side but with branches spreading more or less to make a rather open tassel.
3. Branches growing out from central spike almost horizontally making a loose open tassel.
 - a. Branches tending to remain straight and horizontal and central spike erect.
 - b. Branches drooping considerably.

^{1/} Unpublished data in Annual Report of Corn Investigations conducted by the Division of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture in cooperation with the Iowa Agricultural Experiment Station, Ames, Iowa, 1937 by A. A. Bryan, R. W. Jugenheimer, R. C. Eckhardt and M. S. Zuber.

EXPLANATION OF PLATE I

Tassel types in corn

- Fig. 1a. Branches erect and forming an angle of 20 to 70 degrees with erect central spike.
- Fig. 1b. Branches tending to curve over or droop considerably and forming an angle of 20 to 70 degrees with erect central spike.
- Fig. 1c. Branches as in 1b but central spike is drooping.
- Fig. 2a. Branches erect and forming an angle of less than 20 degrees with erect central spike.
- Fig. 2b. Branches and central spike tending to droop over to one side with tassel remaining compact. Branches form an angle of less than 20 degrees with central spike.
- Fig. 2c. Branches and central spike drooping and curving over but with branches spreading more or less to make a rather open tassel. Branches form an angle of less than 20 degrees with central spike.
- Fig. 3a. Branches tending to remain straight and horizontal and central spike erect.
- Fig. 3b. Branches growing out from central spike almost horizontally and drooping considerably from erect central spike.
- Fig. 3c. Drooping branches growing out horizontally from drooping central spike.

PLATE I



c. Branches and central spike tending to curve over or droop.

Length. The total length of the tassel is the distance from the lowermost tassel branch to the tip of the central spike. This distance is given in centimeters. The average length of the tassels for all the inbreds varies from 21 to 44 cm. A variation of 5 to 10 cm may be expected for the lengths of the tassels of any one line. Some inbreds have typically short tassels. Other inbred lines have long tassels. This character is given in the descriptions of the lines but it is not used in the keys.

Central spike. The central spike of the corn tassel has several distinguishing characteristics. In this study, two of these characters, total length and the number of centimeters that the central spike exceeds the lateral branches, were recorded. The total length is the distance from the uppermost lateral branch to the tip of the central spike; the average lengths in all of the lines varies from 12 to 32 cm. The figures given in the descriptions are the range in variation of the individual central spikes.

The average distance that the central spike exceeds the lateral branches varies from 3 to 12 cm for the different lines. This character is useful in the identification of some lines.

Tassel branches. The length of the lateral or tassel branches is the distance in centimeters from the point of origin to the tip of the branch. The length given is the average distance for any one tassel, i.e., the numbers represent the range in variations of the individual tassels and not of the individual tassel branches. The length of the tassel branches to the total length of the tassel is also given; this character was not used in the key but it is a fairly constant character and should prove useful in the identification of other inbred lines.

The number of tassel branches is quite variable but is very useful in dis-

tinguishing some lines from others. The range in number for the individual tassels is given. The different lines vary from as low as 4 to as high as 65 tassel branches. The variations in the number of tassel branches for any one line is usually less than ten.

Density classes of indefinite limits are established in this classification. This character refers to the number of spikelets per unit of length; it is the relative and not the actual number of spikelets per unit length. The tassel branches are described as three density classes, viz., lax, mid-dense, and dense. This character appears to be mostly responsible for another character, viz. bareness of the side of the rachis facing the central spike. Those inbreds that were not bare or exposed on the inner side of the rachis were also dense. The greater number of inbreds fell into the class middense. The inner side of the rachis of the tassel branches was bare on both of the lax and middense groups. In the classification of a larger number of inbred lines a group should consist of a definite number of spikelets per unit length and not merely as a grade.

Spikelet. The larger number of inbred lines fall into the group in which the lower spikelet is sessile or nearly so. This means that the pedicel of the lower spikelet is mostly 0 to 0.5 mm long; although a few pedicels may be longer than this, the average length of the pedicel is still 0.5 mm or less. The other inbred lines fall into the group in which the lower spikelet is pedicellate, the length of the pedicel ranging from 1 to 6 mm. The upper spikelet of all the lines is pedicellate. The pedicel varies from 1 to 11 mm in length while the pedicels of the individual lines varies only 2 to 3 mm in length. This character proves rather useful for classification work in inbred lines.

The lengths and widths of the different spikelet parts are much less variable under varying climatic conditions than are the vegetative parts. For

this reason, spikelet parts are used to a considerable extent in the classification of the different inbred lines.

Glume. Color. The color of the glume consists of the color of three regions, viz., the nerves, the glume edges, and the area between the nerves. The nerves are all classed as green. The difference in intensity of the greenness of the nerves was not recorded. The glume edges of the different lines are: (a) the same color as the area between the nerves, (b) a definite reddish, brown or reddish brown in color or, (c) only slightly tinged with red or purple. The area between the nerves is, for most lines, whitish and translucent in appearance. In other lines it is slightly to rather heavily tinged with red or purple. The amount of coloring in the glumes is dependent upon environmental as well as genetical factors. With this in mind, care must be exercised in the use of these characters.

Size. The sexual parts of a plant are much less subject to the effects of environment than are vegetative portions of the plant. The lengths and widths of the glumes are fairly constant if care is exercised in the selection of these parts. In this study, the glumes from spikelets which had shed pollen, were used for these measurements. By this method, a fairly constant figure was obtained. In the descriptions, the length of the glume is generally given as a variable between two lengths of one mm difference. This more nearly approaches actual conditions than if one single figure is given. The glume lengths for the different lines vary from 7 to 13 mm. The second glume is generally about one mm shorter than the first glume. The glumes of the different lines vary in width from three to six mm. In some lines the first glume is wider than the second glume; in other lines the reverse is true; and in still other lines there appears to be little, if any, difference in the widths of the first and the second glumes.

Nerves. The number of nerves in the glumes will appear at first to be as variable within lines as between lines. Upon further study, it will be noticed that there may or may not be branching of the nerves. In still other instances, the first glume of the upper spikelet will differ from the first glume of the lower spikelet in the number of nerves. The same phenomenon may hold true but less frequently, for the second glumes of the upper and lower spikelets. Therefore, care must be exercised in the counting. Good results are obtained by counting the number of nerves across the center of the glume and then tracing each nerve to the base, in order to be certain that no branching occurs. The same results are obtained by counting the nerves just above the base of the glume. The number given in the description is the number of nerves occurring the most frequently as the result of several counts. Further and more detailed study as to the branching and point of origin of the nerves are considered to be necessary for the full use of this character in identification work. Hitchcock (1935) uses this character very successfully in his identification work in grasses. The nerves on the second glume usually are less in number and less branched than those on the first glume. The smaller number of nerves facilitates counting. Therefore, the number of nerves on the second glume is considered to be the more useful.

Lemma. Size. The lemma in matured spikelets is fairly constant as to length. The one considered here is the lemma of the lower floret and is adjacent to the first glume. The lemma of the second floret was not measured. The length of the lemma of the different lines varied from 6 to 11 mm.

Nerves. The number of nerves on the lemma are, for the most part, distinct. However, the lemmas of some lines have very indistinct nerves. This number varies from two to six, with the majority of lines having either three or five nerves. The nerves of about two-thirds of these inbred lines converged

as they neared the tip or summit of the lemma. In the other lines, these nerves remained parallel and did not converge at the summit of the lemma. The number of nerves and their behavior toward the summit of the lemma are very usable characters in identification work in corn because of their definiteness and constancy. These and other lemma characters (nature of tip, width, texture, distinctness of nerves; etc.) should prove very usable in future identification work on inbred lines of corn.

Palea. Length is the sole character recorded on the palea. The palea considered here is the one on the upper floret or the one adjacent to the second glume. The different lines varied from 4 to 8 mm in the length of the palea. The characters listed for the lemma may also be applied to palea with considerable success in classification work.

Anthers. The color of the anthers, if used cautiously, can be very useful in distinguishing between certain inbred lines. The anthers of the different lines vary from yellowish green to a bright red or a purple. Environmental conditions at the time of pollen shedding may affect this character considerably. If the tassels are not blasted before or during pollen shedding, the full and normal development of pigmentation of the anthers may be expected. Several other stamen characters as shape of anther, manner of pollen shedding, shape and character of filament, etc., will be usable in future classification work.

Silk Characters

Of the silk characters, the color of the style and of the stigmas or stigmatic hairs on the style were described. The colors are green, pink, red, and dark red for each. The style and the stigma are not necessarily the same color. These characters are obvious and are distinguishing characteristics for several inbred lines. Some caution must be observed in taking color notes too

early or under adverse conditions. In certain inbreds, the silks do not begin to color to any extent until they are some distance out of the shucks. In other lines, the coloring occurs before the silks emerge from the shoot. The silks of certain lines may turn slightly brown under adverse conditions and upon casual observation they may appear as pink or red when they are, in reality, green.

Ear Characters

Length. The length of the ear is described as short, midlong and long. This character is not given for all of the lines due to the fact that ears were not produced on all inbreds. The length is relative and should be taken from a representative group of ears rather than from any one single ear. This is a minor characteristic in classification work due to the influences of environment. Under good corn growing conditions this character could prove very useful in the identification of inbreds.

At some future date, a key that is based on ear and kernel characters should be developed. Such a key is not at all impossible and would be very useful, because of the fact that the kernels and sometimes the ear are the only plant parts available.

Shape. The shape of the ear is described as cylindrical and tapering. Several other shapes would be necessary when more lines are used. The different shapes can only be determined when well filled and well pollinated ears are produced. The shape is therefore very dependent upon environmental influences. In the lines studied, ears were not available in every case and therefore the shape is not given for some.

Height above ground. The ear or ear shoot of these lines is borne between the fifth and tenth nodes. This character is constant for any certain inbred line, usually the variation is only one node. Slight differences may

be expected between listed and surface planted corn. The data are for surface planted corn.

The exact height of the ear or ear shoot from the ground is the distance from the node on which the ear shoot is borne to the surface of the ground. In the description, the height of the ear shoot is given as the proportion of the distance up on the culm to the total height of the plant. This relative height is considered to be much more reliable for a variety of conditions than is the actual height.

Kernel rows. The number of kernel rows within a certain inbred line is quite variable, but not as much so as between lines. This character is of minor importance for classification work but may be used dependably when the lines are grown under conditions that are favorable for pollination and fertilization. This character should be constant for each inbred. Favorable conditions would be necessary to determine this.

Cob color. The cobs are described as white or some shade of red. The color of the cob is one of the main distinguishing characteristics of inbred lines. This character is very obvious and not easily mistaken. This character constitutes the second subdivision of the mature plant key. Several other cob characteristics should also prove valuable in the identification of inbred lines.

Kernel Characters

Color. As the color of the seed is very obvious and may be noted at the time of planting and harvesting, the first main division in the key is seeds white and seeds not white. Among the white seeded lines, there is not much variation in the white color, but it may vary from a translucent white to a cloudy white. However, among those inbreds classed as seeds not white, there is considerable variation in color. The different lines are pink, various

shades of yellow, orange, red or various combinations of these. No inbred lines with purple, blue or black kernels are included in this study.

Size. The kernels are described as small, midlarge and large. The size of the kernels of the different inbreds varies considerably but is fairly constant within a line. The grouping is relative and not based on any actual size although there is no reason why it could not be. The groups might just as well be based on the weight of a hundred or a thousand seeds or the number of seeds per ten or one hundred cubic centimeters. Such a classification would be much more usable than the relative grouping used in this work. A definite grouping was not used because of the limited supplies of some of the seeds.

Other characters. The above described characters are the only ones considered here. However, in future classification work, there are several other characters that may prove valuable. These are such characteristics as the shape of the kernel, the size of the germ, the size of the "crease" or indentation of germ, the amount and nature of the denting of the kernel, the length and width of the kernel, the nature of the tip cap, germination percentages, time of germination, the color of the plumule, and several others. With this partial list of characteristics in mind, it is easy to conceive how a key that is based solely on ear and kernel characteristics might be developed. Sturtevant (1939) attempted such a classification for the varieties of corn. He explained several ear and kernel characters which he found useful in describing varieties of corn. Other useful references would be Eyster (1934) and Emerson, Beadle and Fraser (1935).

CLASSIFICATION OF INBRED LINES OF CORN

Three keys are presented for the inbred lines of corn. Each has a definite purpose. A standard form was followed in making up these keys. They

show that inbred lines can be classified and also the method by which they were classified. The data for this work were collected at Manhattan, Kansas in 1940. No attempt was made to place these lines in the different subgroups of Zea mays as they are lines developed from dent varieties.

The use of keys in the description and classification of other crops has been very helpful and of great importance. Such keys were described for grasses by Hitchcock (1935), for wheat varieties by Clark and Bayles (1935) and for the sorghum varieties by Vinall, Stephens and Martin (1936). In view of the proven success of the above mentioned keys, it is felt that a similar key for the inbred lines of corn will not only prove very useful but will be definitely advantageous in advancing the knowledge of the corn plant.

Keys of some hay and pasture grasses have been prepared by various authors (Coppie and Aldous, 1932; Keim, Beadle and Frolik, 1932; Mowesad, Swales and Dore, 1936; and Hitchcock, 1937). These were based on vegetative characters. The "Vegetative key for inbred lines of corn" and the "Supplementary vegetative key for inbred lines of corn" were based on characters similar to those used by the above mentioned works.

Vegetative Key to Inbred Lines of Corn

The purpose of a vegetative key of inbred lines of corn is for the identification of lines before the time of pollen shedding. This would prove useful in the roguing of detasseling plots. It would also be a valuable aid to the inspectors of detasseling blocks in identification work.

The vegetative characters are influenced to a large extent by environmental conditions. Therefore, caution must be observed in the use of this key as with all vegetative keys. However, if an entire row or field is observed rather than an individual plant, this key appears to be very dependable.

Further study into seedling characters will add to the efficiency of this key and will be necessary as more lines are added.

Vegetative Key to Inbred Lines of Corn

- 1a. Ligules mostly less than 3 mm high. (see also 1b and 1c).-----
- 2a. Leaves heavily wrinkled throughout-----U.S. 3.
- 2b. Leaves not heavily wrinkled throughout.
- 3a. Leaves dark green.
- 4a. Leaves very wavy.
- 5a. Leaves distinctly creased lengthwise; leaf curl opening flattened-----U.S. 187-2.
- 5b. Leaves little or not creased lengthwise; leaf curl opening round, small-----E4.
- 4b. Leaves wavy to not wavy.
- 5a. Leaves short; leaf curl 2 to 3 leaved, midopen-----I234.
- 5b. Leaves midlong to long; leaf curl 1 to 2 leaved, small opening.
- 6a. Leaves narrow, nonrigid-----38-11.
- 6b. Leaves midwide, semirigid-----U.S. 2.
- 3b. Leaves light to medium green.
- 4a. Leaves not wavy, ascending-----I205.
- 4b. Leaves wavy to very wavy, mostly spreading.
- 5a. Leaves distinctly creased lengthwise; plants very vigorous-----B2.
- 5b. Leaves not or little creased lengthwise; plants vigorous but not especially so.
- 6a. Leaf curl opening flattened-----Fr(0sf).
- 6b. Leaf curl opening round.
- 7a. Leaves short, narrow-----Oh 51.
- 7b. Leaves midlong, midwide-----L289.
- 1b. Ligules mostly 3 to 4 mm high. (see also 1c).-----
- 2a. Leaves dark green, very ascending-----ITE701.
- 2b. Leaves light to medium green.
- 3a. Leaves very wavy.
- 4a. Leaves short-----C1447.
- 4b. Leaves midlong.
- 5a. Leaves wide, semirigid, creased lengthwise-----U.S. 1.
- 5b. Leaves midwide, nonrigid, not creased lengthwise-----U.S. 5.
- 3b. Leaves nonwavy to wavy.
- 4a. Leaves narrow, spreading to ascending.
- 5a. Plants not vigorous; leaf curl 1 to 2 leaved-----I224.
- 5b. Plants vigorous; leaf curl 2 to 4 leaved.
- 6a. Leaves medium striped-----R1549.
- 6b. Leaves not striped or very little so-----J.C. 35.
- 4b. Leaves midwide to wide.
- 5a. Leaves conspicuously drooping-----Os426.
- 5b. Leaves spreading.
- 6a. Leaves distinctly creased lengthwise, long; plants very vigorous-----U.S. 4-3.
- 6b. Leaves not creased lengthwise, midlong; plants vigorous.
- 7a. Leaf curl 2 to 3 leaved, midopen-----AF9.
- 7b. Leaf curl 2 leaved, open-----C.

- 1c. Ligules more than 4 mm high.
- 2a. Leaves heavily wrinkled throughout-----B4.
- 2b. Leaves not heavily wrinkled throughout.
- 3a. Leaves dark green.
- 4a. Leaves long, not striped-----U.S. 7.
- 4b. Leaves midlong, partly striped.
- 5a. Plants of medium vigor; leaf curl midopen to open; leaves somewhat wavy-----L317.
- 5b. Plants vigorous; leaf curl midopen; leaves not wavy-----L3.
- 3b. Leaves light and medium green.
- 4a. Leaves not wavy or very little so.
- 5a. Leaves spreading, nonrigid-----Mo401.
- 5b. Leaves mostly ascending, semirigid to rigid.
- 6a. Leaves distinctly creased lengthwise, striped-----Hy.
- 6b. Leaves not creased lengthwise, not striped-----Kys.
- 4b. Leaves wavy.
- 5a. Leaves short, narrow-----B1345.
- 5b. Leaves midlong to long, midwide to wide.
- 6a. Leaves distinctly striped-----U.S. 6.
- 6b. Leaves not distinctly striped.
- 7a. Plants very, vigorous early germinating; leaf curl 2 to 3 leaved, midopen-----Os420.
- 7b. Plants vigorous, midearly to late germinating; leaf curl 1 to 2 leaved, opening small; leaves longer and more drooping---Tr.

Supplementary Vegetative Key to Inbred Lines of Corn

The supplementary vegetative key is not intended to replace the vegetative key but rather to supplement it. It is another method by which inbred lines can be identified on vegetative characters. The vegetative key will probably be more useful for most of the lines used in this study.

This key is constructed in the form of a table. The lines form one of the headings while vegetative characters form the other heading. The outstanding characteristics or the extremes of the different groupings were used to construct the key which is given on the following pages.

Supplementary Vegetative Key to Inbred Lines of Corn

Characters	Inbred line													
	R4	HY	BE	JG33	33-11	BF9	IT	POB	224	224	229	237	345	401
Leaf curl opening flattened	X													
Leaf curl spiraled and projecting				X										
Plants especially vigorous when young			X											X
Plants weak in early stages of growth									X			X		
Leaves heavily wrinkled	X													
Leaves distinctly creased lengthwise	X		X		X									
Leaves rigid	X		X											
Leaves distinctly striped	X		X											
Leaves very wavy							X				X			
Wrinkles on leaves like bulges														
Leaves distinctly ascending	X		X		X									
Leaves dark green	X												X	
Leaves light green			X											
Leaves wide														
Ligule mostly 6 to 7 mm high			X											
Leaves distinctly drooping														X

Supplementary Vegetative Key to Inbred Lines of Corn

Characters	CI	YTN	Fr- 701	(Cnf)	Kys	K4	G	L3	Obsl	Inbred Line									
										U.S.	U.S.	U.S.	U.S.	U.S.	U.S.	U.S.	U.S.	U.S.	U.S.
	447	701								1	2	3	3	6	7	197-2	4-8		
Leaf curl opening flattened					X													X	
Leaf curl spiraled and projecting																			
Plants especially vigorous when young			X											X	X				X
Plants weak in early stages of growth						X													
Leaves heavily wrinkled													X						
Leaves distinctly crossed lengthwise									X								X		X
Leaves rigid			X			X													
Leaves distinctly striped																			
Leaves very wavy														X					
Wrinkles on leaves like bulges			X		X	X				X				X	X				
Leaves distinctly ascending																			X
Leaves dark green			X																
Leaves light green						X							X				X		
Leaves wide					X														
Ligule mostly 5 to 7 mm high																			
Leaves distinctly drooping																			X

Mature Plant Key to Inbred Lines of Corn

In this key, no attempt is made to distinguish between the different subspecies of corn because of the small number of inbred lines used. The lines used here are mostly from dent varieties. It is the purpose in this key to form a basis for a far more extensive key and not solely for the identification of these inbreds. Such a key preferably should be based on easily distinguishable seed and ear characteristics and otherwise on tassel characters. This would allow the lines to be identified from seed and ear samples and tassel specimens. Plant characters such as relative dates of maturity, disease resistance, drying ability, combining ability, etc., while very important from an agronomic standpoint, are undesirable in an identification key unless taxonomic differences sufficiently definite to distinguish between inbred lines from ear and tassel characters, are not apparent.

In the following key, those ear and tassel characters which allow for the greatest contrast and are readily apparent are given primary importance and are used in regular order. When necessary, minor characters are used to bring out differences between lines that are similar. Recovered and second cycle lines fall into this group. Such a group may have to be distinguished mostly on agronomic characteristics.

Mature Plant Key to Inbred Lines of Corn

- 1a. Seeds white; cobs white; red ring at base of spikelet-----J.C. 33.
- 1b. Seeds not white.
- 2a. Cobs white.
- 3a. Tassel branches arising at 20 to 70 degree angle with the central spike.
- 4a. Tassel branches drooping-----U. 7.
- 4b. Tassel branches erect or nearly so-----KY.

- 3b. Tassel branches arising at more than or less than a 20 to 70 degree angle with the central spike.
- 4a. Tassel branches arising at less than 20 degree angle with central spike; leaves wide-----U.S. 1.
- 4b. Tassel branches arising at more than 70 degree angle with central spike; leaves midwide-----U.S. 5.
- 2b. Cobs red.
- 3a. Tassel branches arising at more than or less than a 20 to 70 degree angle with the central spike.
- 4a. Styles red; stigmas red-----Oh 51.
- 4b. Styles green; stigmas green.
- 5a. Nerves on lemma parallel and not converging at summit-----U.S. 4-8.
- 5b. Nerves on lemma converging at summit.
- 6a. First glume 10 mm or less in length-----K4.
- 6b. First glume more than 10 mm in length-----Cl 447.
- 3b. Tassel branches arising at a 20 to 70 degree angle with the central spike.
- 4a. Tassel branches drooping.
- 5a. Tassel branches mostly less than 14 in number.
- 6a. Pedicel of upper spikelet mostly 1 mm in length-----I205.
- 6b. Pedicel of upper spikelet considerably more than 1 mm in length.
- 7a. First glume mostly 10 mm in length-----W79.
- 7b. First glume considerably more than 10 mm in length-----Os420.
- 5b. Tassel branches more than 14 in number.
- 6a. Nerves on lemma parallel and not converging at summit-----L209.
- 6b. Nerves on lemma converging at summit.
- 7a. Nerves on lemma indistinct-----L3.
- 7b. Nerves on lemma distinguishable-----L317.
- 4b. Tassel branches erect or nearly so.
- 3a. Leaves heavily wrinkled.
- 6a. Tassel branches less than 12 in number; styles green-----R4.
- 5b. Tassel branches more than 12 in number; styles light red-----U.S. 3.
- 5b. Leaves not heavily wrinkled.
- 6a. Styles red; stigmas red.
- 7a. Nerves on lemma parallel not converging at summit-----Hy.
- 7b. Nerves on lemma converging at summit-----I234.
- 6b. Styles green.
- 7a. Stigmas red.
- 8a. Tassel branches less than 14 in number-----I224.
- 8b. Tassel branches more than 14 in number.
- 9a. Lower spikelet pedicellate-----G.
- 9b. Lower spikelet sessile or nearly so-----Tr.
- 7b. Stigmas green.
- 8a. Tassel branches mostly less than 14 in number.
- 9a. Nerves on lemma parallel not converging at summit; leaves drooping-----Os426.
- 9b. Nerves on lemma converging at summit.
- 10a. Pedicel of upper spikelet less than 3 mm in length.
- 11a. Three nerves on lemma-----B1349.
- 11b. More than 3 nerves on lemma-----Kr(0sf).
- 10b. Pedicel of upper spikelet more than 3 mm in length.
- 11a. Three nerves on lemma-----U.S. 2.
- 11b. More than 3 nerves on lemma-----U.S. 187-2.

- 8b. Tassel branches more than 14 in number.
 9a. Nerves on lemma converging at summit.
 10a. Glume edges not reddish brown; plants tall-----17A701.
 10b. Glume edges reddish brown.
 11a. First glume more than 10 mm long; plants short-----10c401.
 11b. First glume about 10 mm long; plants tall; leaves striped----U.S. 6.
 9b. Nerves on lemma parallel not converging at summit.
 10a. Pedicel of upper spikelet about 3 mm in length-----B1045.
 10b. Pedicel of upper spikelet considerably more than 3 mm in length.
 11a. Lower spikelet pedicellate-----38-11.
 11b. Lower spikelet sessile or nearly so-----32.

DESCRIPTION OF INBRED LINES OF CORN

The description, synonyms, origin and agronomic characteristics are given for each of the inbred lines of corn used in this study. A uniform plan was used in reporting this information, i.e., general plant characters always precede culm characters, central spike characters precede tassel branch characters and so on. The description is given first. This is followed by the origin and then the agronomic characteristics. The synonyms, if any, are given last.

The detailed description, which includes the more important taxonomic characters that were used in the keys, contains much additional information. These descriptions are far from complete, especially for the information on kernel and ear characters. However, the descriptions are considered to be sufficiently inclusive to afford a comprehensive knowledge of the inbred lines of corn used in this study. When measurements are given, the first figure represents the smallest or lowest end of the range, the figure in parentheses is the average size or length, and the last figure represents the high end of the range. The characters given here were taken from the material described under "Materials and Methods".

The agronomic characteristics and the origin of these lines were adapted from two reports. These are Bryan and Jugenheimer (1937) and Jenkins (1939).

The origin was traced back to the parent variety and the originating station or individual. In most cases, the year or years of origin and the person responsible for producing the line was not given in the literature. The pedigrees of these lines were not given. The data on agronomic characteristics are not as complete for some lines as for others.

Each station assigns a number to each inbred line of corn. The number will be one that does not conflict with one given to another inbred line. Therefore it is usually necessary to assign a new number to the corn belt lines that are in use at several stations. In most instances, this number is not for general public use but it is known only to experiment station workers. Therefore only those synonyms that are in general usage are given. Few of the lines have such synonyms.

The inbreds were grouped under the originating station which produced them. The stations were placed in alphabetical order with Illinois first and the Bureau of Plant Industry last. Several pictures are given at the end of the descriptions. The number on the picture corresponds to the number that is placed before the name of the inbred at the top of each description.

1. B4

Description. Plants early germinating, vigorous, early, tall; culm reddish green, midlarge, midlong internodes; nodes not prominent, 19-20 total, 12-15 above ground, 7 below ground; brace roots on first node above ground or none; suckers few or none; leaves midlong, midwide, dark green, heavily wrinkled throughout, rigid, ascending, creased lengthwise, midwavy, distinctly striped; leaf curl 2-3 leafed, spiraled, projecting, midopen; ligule 4-5 mm high; edges of leaf sheath pilose; collar pubescent to pilose; tassel type 1a with some 1b types, 29-(36)-44 cm long; peduncle midlarge; central spike exceeding lateral

branches 4-7 cm, 23-31 cm long; lateral branches 17-(19)-21 cm long, 7-(9)-11 in number, more than one-half the length of the tassel, middense to lax, inner side of rachis bare; lower spikelet sessile or nearly so; pedicel of upper spikelet 3-5 mm long; glumes mostly whitish between greenish nerves, edges reddish brown; first glume 9-10 mm long, about 5 mm wide, 11 nerved; second glume 8-9 mm long, about 5 mm wide, 8 nerved; lemma 7-8 mm long, 2 parallel nerves not converging at the summit, square topped, pectinate; palea 6 mm long; anthers yellowish green; styles light red; stigmas very dark red; ear long, tapering, 18-20 irregular kernel rows, on sixth node above ground or about one-third of the way up on culm; kernels shallow, midlarge, irregular shaped on most of the ear, golden yellow; cobs dark red.

Origin. This line was developed by J. R. Holbert from Funk Yellow Dent at Bloomington, Illinois.

Aeronomic characteristics. Poor stalk and root quality, good grain quality, tendency to 2 ears per plant, resistant to ear rots but damaged by stalk rots, susceptible to cold in early fall, resistant to corn borer, resistant to wilting and firing of the leaves, slightly susceptible to tassel firing, dried quickly following maturity, little smut. The upper leaves cling around the tassel until it is ready to shed pollen. This line is a fair pollen shedder and has good husks.

2. Hy

Description. Plants vigorous, midseason, midtall; culm reddish green, midlarge, midlong internodes; nodes not prominent, 19-21 total, 13 above ground, 7-8 below ground; brace roots on first 2 nodes above ground; suckers few to none; leaves short to midlong, midwide, light green to yellowish green, little or no wrinkling, rigid, ascending, some creasing lengthwise, little to no waviness, some to distinct striping disappearing with age; leaf curl 1-3 leafed, midopen;

ligule 5-7 mm high; edges of leaf sheath pilose; collar pubescent to pilose; tassel type 1a, 30-(34)-38 cm in length; peduncle midlarge; central spike exceeding lateral branches 6-(8)-11 cm, 21-35 cm long; lateral branches 13-18 cm long, 13-18 in number, one-half the length of the tassel, middense, inner side of rachis bare; lower spikelet pedicellate, pedicel usually 1 mm long; pedicel of upper spikelet mostly 4 mm long; glumes white between greenish nerves becoming slightly reddish at time of pollen shedding; first glume 8-9 mm long, 4 mm wide, 11 nerved; second glume 7-8 mm long, 4 mm wide, 9 nerved; lemma 7 mm long, 3 parallel nerves not converging at the summit; palea 5-6 mm long; anthers yellowish green and purple; styles light to medium red; stigmas light to medium red; ears about 5 inches long, cylindrical, on eight node above ground, almost half way up on culm, 16 kernal rows; kernels large, deep, good width and thickness, often a lemon colored cap on the yellow pericarp; cobs red.

Origin. This line was developed by A. M. Brunson from Illinois High Yield at the Kansas Agricultural Experiment Station, Manhattan, Kansas. It was received by J. R. Holbert as a five-year inbred; he demonstrated its usefulness in the Illinois corn breeding program.

Agronomic characteristics. This line transmits good stalk and root quality to its crosses. It is fairly resistant to wilting and firing of leaves and tassel, resistant to root worm, not greatly damaged by chinch bugs but sometimes damaged by grasshoppers, susceptible to leaf smut, and a tendency for susceptibility to cob rot. The pericarp of the grain is often split, thus giving poor quality seed.

3. B2

Description. Plants early germinating, very vigorous, early to midseason, midtall; culm greenish red, midlarge, midlong internodes; nodes not prominent,

20-21 total, 12-13 above ground, 8 below ground; brace roots up to third node above ground; suckers few to none; leaves long, midwide, light to medium green with a whitish green leaf margin, wrinkled, not rigid, spreading, creased lengthwise, midwavy, little to no striping, margins of the younger leaf tips heavily wrinkled with some wrinkling in other parts; leaf curl 2-3 leaved, mid-open; ligule 2-3 mm high; edges of leaf sheath pilose; collar puberulent; tassel type 1a, 35-(41)-45 cm long; peduncle midlarge; central spike exceeding lateral branches 8-(12)-14 cm, 25-(30)-35 cm long; lateral branches 14-(17)-19 cm long, 10-(15)-19 in number, less than one-half length of tassel, middense, inner side of rachis bare; lower spikelet sessile or nearly so; pedicel of upper spikelet 5-6 mm long; glumes mostly white between greenish nerves, white and red edges; first glume 11-13 mm long, 5-6 mm wide, 12 nerved; second glume 10-11 mm long, 5 mm wide, 8 nerved; lemma 9 mm long, 3 nerves parallel, not converging at the tip; palea 6-7 mm long; anthers yellowish green; styles green; stigmas green; ear midlarge to large, cylindrical, on sixth node above ground, about one-third of way up on culm, 12-14 kernel rows; kernels yellow midlarge; cobs red.

Origin. The parent variety is Reid Yellow Dent. This line was developed at the Indiana station.

Agonomic characteristics. This line is stiff-stalked, good rooted, drought susceptible and rot susceptible.

4. J.C. 33

Description. Plants medium to early germinating, fairly vigorous, mid-season, tall; culms reddish, midlarge to large, midlong to long internodes; nodes not prominent, 21 total, 13-14 above ground, 6 below ground; brace roots on first and second nodes above ground; suckers few to none; leaves midlong, narrow to midwide, midgreen, little to not wrinkled, not rigid to semirigid,

ascending to spreading, little crossing lengthwise, little to no waviness, not striped; white or yellow stripes on some first leaves; leaf curl 2-3 leafed, midopen to open; ligule 3-4 mm high; edges of leaf sheath pilose to villous; collar pubescent to pilose; tassel type mostly 1a with some 3a, 37-(40)-45 cm long; peduncle midlarge; central spike exceeding lateral branches 4-(6)-8 cm, 21-(24)-25 cm long; lateral branches 17-19 cm long, 14-(16)-21 in number, less than one-half length of tassel, lax to middense, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 6-8 cm long; glumes reddish and white between greenish nerves with a characteristic red ring around base of spikelet; first glume 9 mm long, 4 mm wide, 8-10 nerved; second glume 8-9 mm long, 4 mm wide, 6 nerved; lemma 7 mm long, 3 nerves converging at summit, palea 5-6 mm long; anthers yellowish green; styles green; stigmas green; ear small, cylindrical, on seventh or eight node above ground, less than one-half way up on culm, 14-16 kernel rows; kernels white, midlarge; cobs white.

Origin. The parent variety is Lux Johnson County White. This line was developed by the Purdue Agricultural Experiment Station. Up until the Corn Conference report in 1958, J.C. 33 was only used in the top cross test JCK No. 1.

Agonomic characteristics. This line has good standing ability and good pollen. The top leaves may fire under some conditions.

Synonyms. It is also called 33-16.

5. 39-11

Description. Plants midearly germinating, medium vigor, midseason, mid-tall; culms reddish, midlarge to large, midlong internodes; nodes more or less prominent, 21-23 total, 12-14 above ground, 9 below ground; brace roots on first 2 nodes above ground, heavy, thick; suckers few to none; leaves midlong

to long, narrow to midwide, dark green, little wrinkling on lower part of blade and more so toward edges, not rigid, spreading to ascending later drooping, creased lengthwise, midnervy, little stripedness; leaf curl 1-2 leaved, midopen with spiraled and projecting top leaf; ligule 2-3 mm high; edges of leaf sheath glabrate; collar puberulent; tassel type 1a, 30-(40)-45 cm long; peduncle midlarge; central spike exceeding lateral branches 10-(12)-15 cm, 21-25 cm long; lateral branches 15-25 in number, 14-20 cm long, less than one-half length of tassel, lax, inner side of rachis bare; lower spikelet pedicellate, pedicel 3 mm long; pedicel of upper spikelet 9-11 mm long; glumes mostly white (some red) between greenish nerves; first glume 11-12 mm long, about 4 mm wide, 9 nerved on upper spikelet, 4-5 nerved on lower spikelet; second glume 9-10 mm long, about 3 mm wide, 5 nerved; lemma 8 mm long, 3 parallel nerves not converging at the tip; palea 6-7 mm long; anthers yellowish green and in some cases brick red; styles green; stigmas green; ear midlong, butts poor, on eight node above ground, less than one-half the way up on culm, 14-16 kernel rows; kernels midlarge, deep yellow or orange, rounded crowns; purple plumbeous; cobs red.

Origin. This line originated from an outcross in a line from 176a. It was developed by the Purdue Agricultural Experiment Station.

Agonomic characteristics. Good stalks, excellent roots, withstands heat and drought, shows tendency for stalk rots in Ohio, grain of medium quality, very long shanks, two-eared tendency.

6. W99

Description. Plants midearly germinating, vigorous, early, midtall; culm reddish green, small to midlarge, midlong internodes; nodes not prominent, 13 total, 11 above ground, 7 below ground; brace roots on first node above

ground or none; suckers few to none; leaves short to midlong, midwide, light to medium green, not wrinkled or only faintly so on some, not rigid, spreading, little to no creasing lengthwise, midway, little or no striping; leaf curl 2-3 leafed, midopen; ligule 3-4 mm high; edges of leaf sheath pilose; some closed leaf sheaths on the upper part of the culm; collar puberulent; tassel type 1b to 1c, 29-(34)-36 cm long; peduncle midlarge; central spike exceeding lateral branches 6-9 cm, 22-28 cm long; lateral branches 15-19 cm long, 9-12 in number, one-half length of tassel, middense, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 2-4 mm long; glumes mostly white between greenish nerves, reddish brown edges; first glume about 10 mm long, 4 mm wide, 9 nerved; second glume about 10 mm long, 4 mm wide, 6 nerved; lemma 8 mm long, 5 nerves converging at summit; palea 6 mm long; anthers yellowish green; styles green; stigmas green; ear rather large, on fifth or sixth node above ground, less than one-third way up on culm, about 14 kernel rows; kernels yellow, midlarge; cobs red.

Origin. This line originated from Indiana Station Reid. It was produced by the Purdue Agricultural Experiment Station.

Agronomic characteristics. This line is stalk and ear rot resistant, very strong stalked, has a strong root system, good quality grain, is susceptible to grain mold, is weak shanked, has deep grain, poor pollen in adverse conditions. The leaves are somewhat resistant to heat and drought but the tassels are moderately susceptible. This line contributes high yield to its crosses.

7. Tr

Description. Plants midearly germinating, vigorous, midseason, short; culms green to reddish green, midlarge, short to midlong internodes with very

short internodes just below tassel making concentration of leaves there; nodes not prominent, mostly 23 total, 14 above ground, 9 below ground; brace roots none; suckers few but may sucker some under favorable conditions; leaves long, midwide, medium green, heavily to medium wrinkled on new blade tip margins and medium wrinkled throughout the lower parts of the older blades, not rigid, spreading to drooping, little creasing lengthwise, very wavy, not striped; leaf curl 1-2 leafed, closed to midopen; ligule 4-5 mm long; edges of leaf sheath pilose; collar fimbriate pilose; tassel type 1a, 24-(30)-34 cm long; peduncle midlarge; central spike exceeding lateral branches 6-(8)-11 cm, 19-(22)-24 cm long; lateral branches 11-(14)-16 cm long, 18-(22)-29 in number, about one-half length of tassel, middense, inner side of rachis partly covered; lower spikelet sessile or nearly so; pedicel of upper spikelet 3-(4)-5 mm long; glumes white and reddish between greenish nerves, reddish brown edges; first glume 8-9 mm long, 3-4 mm wide, 6 nerved; second glume 8 mm long, 4 mm wide, 5 nerved; lemma 7-8 mm long, 3 nerves converging at summit; palea 3-6 mm long; anthers some yellowish green and others very dark red; styles green; stigmas dark red; ear thick, on seventh or eight node above ground, less than one-half way up on culm; kernels dirty yellow, deep, medium indentation; cobs red.

Origin. The parent variety is Troyer Reid. This line was developed at the Purdue Agricultural Experiment Station.

Agonomic characteristics. This line has the following characteristics: fair roots, excellent pollen, susceptible to bud smut, fairly resistant to heat and drought, susceptible to ear mold and lodging, exposed ear tips, medium quality grain, slow drying and contributes deep grain to its single crosses.

8. 1205

Description. Plants vigorous, midseason, midtall; culms reddish, mid-

large, midlong internodes; nodes not prominent, 21-22 total, about 13 above ground, 8-9 below ground; brace roots on first node above ground or none; suckers few to none; leaves midlong to long, narrow to midwide, midgreen, little wrinkling on lower part of blade becoming heavier toward margins with none at tips, semirigid, spreading to ascending, little creasing lengthwise, little to midwavy, not striped; leaf curl 2-3 leafed, midopen; ligule 2-3 mm high; edges of leaf sheath pubescent and later glabrate; some upper leaf sheaths closed; collar puberulent to glaucous; tassel type 1b later becoming 1c, about 27-36 cm long; peduncle small; central spike 16-26 cm long; lateral branches about 16-21 cm long, 7-12 in number, more than one-half length of tassel, middense, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet usually 1 mm; glumes mostly white between greenish nerves, reddish brown edges; first glume 9-10 mm long, about 5 mm wide, 8-9 nerved; second glume 9-10 mm long, 5 mm wide, 5-6 nerved; lemma 8-9 mm long, 2 nerves converging at tip; palea 7-8 mm long; anthers yellowish and reddish green; styles green; stigmas green; ear short with naked cob near tip, on ninth node above ground, about one-half way up on culm, 16-18 kernel rows; kernels dull yellow, midlarge to large; cobs dark red.

Origin. The parent variety is Iodent, a strain of Reid Yellow Dent selected by L. C. Burnett of the Iowa Agricultural Experiment Station.

Agonomic characteristics. This line transmits to its crosses: high yield, resistance to lodging, to chinch bug injury, to smut, and the ability to hold ears. The ears of this line are susceptible to molds and should be harvested early to avoid damage. This line is a good pollen producer.

9. 1234

Description. Plants weak in early stages of growth, midseason, midtall

to tall; culms greenish red, midlarge, midlong to long internodes; nodes more or less prominent, 21 total, 13 above ground, 8 below ground; brace roots on first node above ground or none; suckers few to none; leaves midlong, narrow to midwide, light to midgreen, little wrinkling which is mostly on margins and toward base of blade, not rigid, spreading to ascending, little creasing lengthwise, little to no waviness, not striped; leaf curl 1-2 leafed, midopen; ligule 3-4 mm high; edges of leaf sheath pilose; collar puberulent to pubescent; tassel type 1a, 30-(33)-35 cm long; peduncle small to midlarge; central spike exceeding lateral branches 10-12 cm, about 25-29 cm long; lateral branches 16-18 cm long, 4-5 in number, about one-half length of tassel, lax, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 4-(5)-8 mm long; glumes red and white between greenish nerves; first glume 10-11 mm long, about 4 mm wide, 10 nerved; second glume 9-10 mm long, 4 mm wide, 6 nerved; lemma 8-9 mm long, 3 nerved converging at tip; palea 7 mm long; anthers yellowish green; styles green; stigmas red; ear on sixth node above ground, one-third of way up on culm, 12 kernel rows; kernels yellow, midlarge; cobs red.

Origin. The parent variety is *Iodent* (see I205). It was developed at the Iowa Agricultural Experiment Station.

Agronomic characteristics. This line stands well and suckers little.

10. I234

Description. Plants midearly germinating, medium vigor, midseason, mid-tall; culms green to reddish green, small to midlarge, midlong to long internodes; nodes not prominent, 22-23 total, 12-13 above ground, 10 below ground; brace roots on first node above ground or none; suckers freely; leaves short to midlong, midwide, medium green, little wrinkling only on lower part of blade, not rigid to semirigid, ascending to spreading, little creasing length-

wise, midwavy, not striped; leaf curl 2-3 leaved, midopen; ligule 2-3 mm high; edges of leaf sheath pilose; collar puberulent; tassel type 1a, 24-(29)-34 cm long; peduncle small; central spike exceeding lateral branches 6-10 cm, 14-23 cm long; lateral branches 9-15 cm long, 8-16 in number, less than one-half length of tassel, lax to middense, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 2-(3)-5 mm long; glumes white and red between greenish nerves, reddish brown edges; first glume 9-10 mm long, about 4 mm wide, 8 nerved; second glume 9-9 mm long, about 4 mm wide, 6 nerved; lemma 6-7 mm long, 5 indistinct nerves converging at summit; palea 3 mm long; anthers yellowish green and later becoming bright red; styles green; stigmas green (silks bright red in Iowa); ears on sixth or seventh node above ground, more than one-third of way up on culm, 16-18 kernel rows; kernels deep yellow, midlarge; cobs dark red.

Origin. The parent variety is Iodent (see 1205). This line was developed at the Iowa Agricultural Experiment Station.

Agonomic characteristics. This line contributes to its crosses; yield, rapid drying of grain and freedom from smut. The kernels shatter badly from the inbred ears. This line is very sensitive to unfavorable early growing conditions but withstands drought and heat, and usually produces abundant pollen.

11. L289

Description. Plants midearly germinating, vigorous, early to midseason, distal; culms green to reddish green, midlarge, midlong to long internodes; nodes not prominent, 18-19 total, 12 above ground, 6-7 below ground; brace roots none; suckers few to none; leaves midlong, midwide, medium green, little wrinkling scattered throughout the blade, not rigid, ascending to spreading,

little creasing lengthwise, wavy, not striped; leaf curl 1-2 leafed, midopen to open; ligule 2-3 mm high; edges of leaf sheath glabrate; collar puberulent to glaucous; tassel type 1b with some 1a, 35-37 cm long; peduncle midlarge to large; central spike exceeding lateral branches 7-10 cm, 22-27 cm long; lateral branches 16-19 cm long, 16-20 in number, about one-half length of tassel, mid-dense, inner side of rachis bare; lower spikelet sessile or nearly so; pedicel of upper spikelet 3-(4)-5 mm long; glumes usually white between greenish nerves, reddish brown edges; first glume 11-12 mm long, 4 mm wide, 12 nerved; second glume 10-11 mm long, 5 mm wide, 8 nerved; lemma 8-10 mm long, 3 parallel nerves not converging at tip; palea 5-6 mm long; anthers mostly yellowish green; styles green; stigmas green; ear long, slender, on seventh or eighth node above ground, more than one-third of way up on culm, 10-14 kernel rows; kernel brownish yellow with yellow cap, smooth, midlarge to large; cobs dark red.

Origin. The parent variety is Lancaster Surecrop, a strain of corn developed by Isaac Hirshey of Lancaster County, Pennsylvania. This line was developed by the Iowa Agricultural Experiment Station.

Agronomic characteristics. This line is susceptible to stalk smut and to diplodia stalk rot, to drought, and sometimes to breaking after maturity. This line usually produces a high yield of quality seed. It is preferably used as the seed parent in making single crosses because of high production and quality of seed, its poor pollen producing ability and its few or no suckers to detassel.

12. 1317

Description. Plants medium vigor, midseason, midtall; culms greenish red to reddish, small to midlarge, midlong internodes; nodes not prominent, 20-21 total, 14 above ground, 6-7 below ground; brace roots on first node above ground or none; suckers few or none; leaves midlong, midwide, dark green, very

little wrinkling only on lower leaf margins of older blades, semirigid to not rigid, ascending and drooping, little creasing lengthwise, little to midvein, some striping disappearing with age; leaf curl 2 leafed, midopen; ligule 4-5 mm high; edges of leaf sheath antrorsely pilose to villous; collar pubescent to pilose; tassel lb type, 25-(29)-31 cm long; peduncle small; central spike exceeding lateral branches 5-8 cm, 13-21 cm long; lateral branches 12-14 cm long, 14-(18)-23 in number, less than one-half length of tassel, middense, inner side of rachis bare; lower spikelet pedicellate, pedicel mostly 1 mm long; pedicel of upper spikelet 2-(2)-4 mm long; glumes mostly white between greenish nerves, some red in glume edges; first glume 9-10 mm long, about 3 mm wide, 9 nerved; second glume 3-9 mm long, about 3 mm wide, 6 nerved; lemma 7-8 mm long, 3 nerves converging at tip; palea 5-6 mm long; anthers yellowish green; styles green; stigmas green; ear long, cylindrical, slender, on eighth node above ground, one-half way up on culm, 14-16 kernel rows; kernels light yellow, small, flinty, susceptible to a splitting of pericarp under some conditions; cob red.

Origin. The parent variety is Lancaster Surecrop (see L289). It was developed at the Iowa Agricultural Experiment Station.

Agonomic characteristics. This line is very resistant to wilting and firing and has medium strong root system and stalks. It contributes resistance to heat and drought.

Synonyms. It is the parent variety of the recovered line L3; it is similar or identical to L317B2.

13. B1345

Description. Plants weak in early stages, late, midtall; culms reddish green, small to midlarge, short to midlong internodes; nodes not prominent,

21-22 total, 12-15 above ground, 9 below ground; brace roots on first two nodes above ground; suckers few to none; leaves short, midwide, medium green, medium wrinkling on lower parts of blade, scattered throughout leaf but heavier on margins, semirigid, ascending to spreading, little to no creasing lengthwise, very wavy, not striped; leaf curl 1-2 leafed, open; ligule 4-5 mm high; edges of leaf sheath pubescent becoming glabrate; collar puberulent to glaucous; tassel type 1a, about 23 cm long; peduncle midlarge; central spike exceeding lateral branches about 4-6 cm, about 15 cm long, 16-19 in number, about one-half length of tassel, middense, inner side of rachis bare; lower spikelet pedicellate, pedicel 0.5-(1)-3 mm long; pedicel of upper spikelet 3-5 mm long; glumes red and white between greenish nerves, reddish brown edges; first glume 9-10 mm long, about 4 mm wide, 9 nerved; second glume 8-9 mm long, 4 mm wide, 5 nerved; lemma 7 mm long, 2 parallel nerves not converging at summit; palea 5-6 mm long; anthers yellowish green and red later turning to brown; styles green; stigmas green; ear midlong, on seventh node above ground, about one-third way up on culm, 16-18 kernel rows; kernels deep yellow, rough, rather starchy, midlarge; cobs red.

Origin. The parent variety is Black Yellow Dent, a strain from Reid Yellow Dent developed by Clyde Black in Dallas County, Iowa, and ranking above the average of the varieties in the Iowa Corn Yield Test through a 16-year period. It was developed at the Iowa Agricultural Experiment Station.

Agronomic characteristics. This line is very weak rooted, susceptible to stalk rot and a fair pollen producer. The seed should be harvested early to prevent losses from lodging.

14. B1349

Description. Plants early to midearly germinating, fairly vigorous,

early to midseason, midtall; culms reddish, midlarge, midlong internodes; nodes not prominent, 22 total, 13-14 above ground, 8-9 below ground; brace roots on first or second nodes above ground; suckers many; leaves midlong, narrow to midwide, midgreen, not wrinkled or very little so, not rigid, spreading, little creasing lengthwise, not wavy, partly striped; leaf curl 2-4 leafed, midopen to open; ligule 3-4 mm high; edges of leaf sheath pilose; collar pubescent to glaucous; tassel type 1a, 22-(27)-29 cm long; peduncle small; central spike exceeding lateral branches 6-9 cm, 18-(21)-22 cm long; lateral branches 12-14 cm, 5-(7)-9 in number, about one-half length of tassel, dense, inner side of rachis not bare; lower spikelet nearly sessile; pedicel of upper spikelet 0-(1)-2 mm long, glumes white between greenish nerves, reddish edges; first glume 10-11 mm long, about 4 mm wide, 11 nerved; second glume 9-10 mm long, 5 mm wide, 9 nerved; lemma 8-9 mm long, 3 nerves converging at summit; palea 6-7 mm long; anthers yellowish green; styles green; stigmas green; ear midlong, on seventh or eight node above ground, less than one-half way up on culm, 12-14 kernel rows; kernels yellow, rough hook, midlarge; cobs red.

Origin. The parent variety is Black Yellow Dent (see B1545). It was developed at the Iowa Agricultural Experiment Station.

Agonomic characteristics. The upper 2-3 leaves of this line are very susceptible to firing but the tassels do not burn except under extreme heat and drought. It is susceptible to ear smut, but generally the percentage of infested ears is small. Pollen shedding is medium.

15. Ne401

Description. Plants weak in vigor, midseason,, short; culms greenish to reddish green, midlarge, short to midlong internodes; nodes not prominent, 19 total, 10 above ground, 9 below ground; brace roots on first or second nodes

above ground; unusually large number of suckers; leaves short, midwide, mid-green, only finely wrinkled on some lower leaf margins, not rigid, spreading, little creasing lengthwise, not wavy to midwavy, partly striped; leaf curl 2-3 leafed, open; ligule 4-5 mm high; edges of leaf sheath pilose; collar puberulent to pubescent; tassel type 1a, 38-40 cm long; peduncle midlarge; central spike exceeding lateral branches 8-10 cm, 27-29 cm long; lateral branches 19-21 cm long, 16-20 in number, slightly more than one-half length of tassel, lax, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 5-(6)-9 mm long; glumes white between greenish nerves, edges reddish brown; first glume 11-12 mm long, 3-4 mm wide, 8 nerved; second glume 10-11 mm long, 3-4 mm wide, 6 nerved; lemma 9 mm long, 3 nerves converging at summit; palea 5-6 mm long; anthers yellowish green to light pink; styles green; stigmas green; ear midlong, on sixth node above ground, less than one-third way up on culm, 14-18 kernel rows; kernels yellow, rough, starchy, midlarge; cobs red.

Origin. The parent variety is McCulloch Yellow Dent, a selection from Reid Yellow Dent developed by Fred McCulloch of Poweshiek County, Iowa and ranking about the average in the Iowa Corn Yield Test through a sixteen-year period. It was developed at Iowa Agricultural Experiment Station, Ames, Iowa.

Agronomic characteristics. This line is resistant to drought and is an excellent pollen producer. The ears are susceptible to ear rots under certain conditions. The seed quality is poor.

16. 03420

Description. Plants early germinating, very vigorous, early, midtall; culms reddish green to reddish, midlarge, midlong to long internodes; nodes not prominent, 19-20 total, 11 above ground line, 8-9 below ground; brace

roots on first node above ground or none; suckers few or none; leaves midlong, midwide, midgreen, very little wrinkling which is on outer one-third of blade and also on most young leaf tips but no on the tips of older leaves, not rigid, spreading, little creasing lengthwise, midwavy, not striped; leaf curl 2-3 leafed, midopen; ligule 4-5 mm high; edges of leaf sheath pilose; collar pubescent to pilose; tassel type 1b, 35-(37)-39 cm long; peduncle midlarge to large; central spike exceeding lateral branches 10-14 cm, 27-(28)-31 cm long; lateral branches 15-17 cm long, 12-(14)-17 in number, less than one-half length of tassel, middense, inner side of rachis bare; lower spikelet pedicellate, pedicel mostly 1 mm long; pedicel of upper spikelet 6-8 mm long, glumes mostly white between greenish nerves, reddish brown edges; first glume 12-13 mm long, 4 mm wide, 11 nerved on upper, 9 nerved on lower; second glume 10-11 mm long, 4 mm wide, 6 nerved; lemma 8-9 mm long, 3 nerves converging at summit; palea 7-8 mm long; anthers yellowish green; styles green; stigmas green; ear mid-long, on fifth or sixth node above ground, less than one-third way up on cula, 14-16 kernel rows; kernels brownish red with yellow caps, rough indentation, thick, large; cobs dark red.

Origin. The parent variety is Osterland Yellow Dent, a strain of Reid Yellow Dent developed by H. F. Osterland of Franklin County, Iowa and ranking above the average in the Iowa Corn Yield Test through a sixteen-year period. It was developed at Iowa Agricultural Experiment Station.

Agonomic characteristics. Ears dry slowly after maturity, resulting in a relatively high moisture content at harvest. It is susceptible to diplodia stalk rot which occasionally causes stalk breaking after maturity, making early harvest of seed desirable. The pollen shedding is medium in Iowa and poor in Nebraska. It has not lodging.

17. Os426

Description. Plants very vigorous, early, midtall; culms reddish, mid-large, midlong internodes; nodes not prominent, 18 total, 11 above ground, 7 below; brace roots on first node above ground or none; suckering rather profusely; leaves midlong to long, midwide, midgreen, some wrinkling, except on upper part of blade, not rigid, drooping, little creasing lengthwise, not wavy, not striped; leaf curl 2 leafed, open; ligule 3-4 mm high; edges of leaf sheath pilose becoming glabrate; collar puberulent; tassel type 1a, 30-(32)-35 cm long, peduncle midlarge to large; central spike exceeding lateral branches 7-9 cm, 24-27 cm long; lateral branches 15-(17)-19 cm long, 5-9 in number, slightly more than one-half length of tassel, middense, inner side of rachis partly bare; lower spikelet nearly sessile; pedicel of upper spikelet mostly 3 mm long; glumes white and red between greenish nerves, reddish brown edges; first glume 10-11 mm long, about 4 mm wide, 10 nerved; second glume 10 mm long, 4-5 mm wide, 8 nerved; lemma 6-9 mm long, 2 parallel nerves not converging at tip; palea 5-6 mm long; anthers yellowish green; styles green; stigmas green; ears midlong, large, on seventh node above ground, more than one-third of way up on culm, 14-16 kernel rows; kernels golden yellow, rough, horny, midlarge; cobs dark red.

Origin. The parent variety is Osterland Yellow Dent (see Os420). This line was developed at the Iowa Agricultural Experiment Station.

Agronomic characteristics. This line produces quality seeds, which are somewhat smaller than those of Os420, is medium in pollen shedding and has some smut susceptibility.

19. C1447

Description. Plants midearly germinating, medium vigor, very early, mid-tall; culms green to reddish green, small to midlarge, midlong internodes; nodes not prominent, 18-19 total, 10-12 above ground, 7-3 below ground; brace roots on first node above ground or none; suckers many; leaves short, midwide, medium green, wrinkled some on lower parts of some blades and upper parts of other blades, not rigid, spreading, little creasing lengthwise, very wavy, not striped; leaf curl 1-2 leafed, midopen; ligule 3-4 mm high; edges of leaf sheath pilose to villous; collar puberulent to pubescent; tassel type 2a, 27-(30)-33 cm long; peduncle midlarge to large; central spike exceeding lateral branches 5-(7)-9 cm, 13-(15)-17 cm long; lateral branches 7-(8)-10 cm long, 30-44 in Kansas and up to 65 in Iowa in number, about one-fourth the length of tassel, middense, inner side of rachis bare; lower spikelet pedicellate, pedicel usually 1 mm long; pedicel of upper spikelet 2-(3)-5 mm long; glumes mostly white between greenish nerves, red and white edges; first glume 12-13 mm long, 4 mm wide, 8 nerved; second glume 11-12 mm long, 4 mm wide, 6 nerved; lemma 9-11 mm long, 5 nerves converging at summit; palea 8 mm long; anthers yellowish green; styles green; stigmas green; ear short, on seventh or eighth node above ground, about one-half way up on culm, 12-16 kernel rows; kernels yellow, small, smooth, flinty; cobs very dark red.

Origin. The parent variety is Clark Yellow Dent, an early strain of Reid Yellow Dent obtained from James Jensen of Newell, Iowa. This line was developed at the Iowa Agricultural Experiment Station.

Agronomic characteristics. The compact tassel of this line is very susceptible to firing; often one-half or more of the tassels are almost completely dead when they emerge from the "boots". The lower part of the tassel

usually sheds pollen. This line is not highly productive and has a 2-eared tendency in Kansas.

19. ITEX01

Description. Plants vigorous, midseason, tall; culms green to reddish green, midlarge, midlong to long internodes; nodes not prominent, 21 total, 15 above ground, 8 below ground; brace roots on first or second nodes above ground; suckers few to none; leaves midlong, narrow to midwide, dark green, not wrinkled to a small amount of wrinkling on margins of blade and faintly scattered in some parts of the blade, rigid, very ascending, little creasing lengthwise, very wavy, little to no striping; leaf curl 2-3 leaved, midopen; ligule 3-4 mm high; edges of leaf sheath hirsute; collar puberulent to pubescent; tassel type 1a, 35-38 cm long; peduncle small to midlarge; central spike exceeding lateral branches 8-10 cm, 20-22 cm long; lateral branches 11-14 cm long, 17-(21)-24 in number, about one-third length of tassel, middense to lax, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 5-(4)-6 mm long; glumes usually white between greenish nerves; first glume 9 mm long, about 4 mm wide, 8-11 nerved; second glume 8-9 mm long, 4 mm wide, 6 nerved; lemma 7-8 mm long, 3 nerves converging at summit; palea 5-6 mm long; anthers yellowish green to a slight red; styles green; stigmas green; ear short, tapering, on eight node above ground, about one-half way up on the culm, 10-12 kernel rows; kernels yellow, small; cobs red.

Origin. This line was developed at the Iowa Agricultural Experiment Station from the variety Illinois Two Ear.

Agonomic characteristics. This line is moderately resistant to wilting and firing, has medium strong root system and stalk, but stalks sometimes break over above ear at maturity, has little smut, and is 2-eared.

Synonyms. This line is very similar to B.P.I. 540 and TMK.

20. Kr(Orf)

Description. Plants vigorous, midseason, tall; culm reddish, midlarge, midlong to long internodes; nodes not prominent, 21 total, 13 above ground, 8 below ground; brace roots on first 2 or 3 nodes above ground; suckers none; leaves midlong, midwide, medium green, wrinkled, not rigid, spreading to drooping, no creasing lengthwise, very wavy, not striped; leaf curl 2-3 leafed, flattened opening; ligule 2-3 mm high; edges of leaf sheath pilose; collar pubescent to pilose; tassel type 1a, 21-33 cm long; peduncle large; central spike exceeding lateral branches 4-(5)-7 cm, 12-29 cm long; lateral branches 11-20 cm long, usually 12-13 in number, about one-half length of tassel, mid-dense, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 1-(2)-4 mm long; glumes red and white between greenish nerves, reddish brown edges; first glume 10-11 mm long, about 4 mm wide, 11 nerved; second glume 9-10 mm long, about 4 mm wide, 6 nerved; lemma 8-9 mm long, 5 nerves converging at summit; palea 6-7 mm long; anthers purple and yellowish green; styles green; stigmas green; ear midlong, on eight node above ground, more than one-third way up on culm, 12-16 kernel rows; kernels brownish yellow with lemon colored cap; cobs red.

Origin. It is a recovered line of 137-2 x 480 and then backcrossed to 137-2. It was developed at the Iowa Agricultural Experiment Station by E. W. Lindstrom.

21. Kys

Description. Plants medium vigor, late, midtall; culm mostly green, midlarge to large with short to midlong internodes; nodes no larger than culm and smaller than normal, 24-25 total, 16 above ground, 8-9 below ground; brace

roots on first and second nodes above ground or none; suckers none; leaves midlong, midwide, light to midgreen, no wrinkling or little on lower parts of older blades, semirigid to rigid, spreading to ascending, some creasing lengthwise, midway to little or no waviness, no striping; leaf curl 2 leafed, midopen; ligule 4-5 mm high; edges of leaf sheath villous; collar pilose; tassel type 1a, 26-(31)-36 cm long; peduncle midlarge; central spike exceeding lateral branches 3-5 cm, 17-(20)-23 cm long; lateral branches 13-17 cm long, 15-(17)-21 in number, about one-half length of tassel, middense, inner side of rachis bare; lower spikelet sessile or nearly so; pedicel of upper spikelet 2-(4)-6 mm long; glumes white between greenish nerves; first glume 9-10 mm long, about 4 mm wide, 11 nerved; second glume 8-9 mm long, 4-5 mm wide, 9 nerved; lemma 7-8 mm long, 3 nerves converging at summit; palea 7 mm long; anthers yellowish green and purple; styles light green, exceptionally long and heavy brush; stigmas green; ear short, cylindrical, 14-16 kernel rows, on tenth node above ground, about one-half way up on culm; kernels whitish orange or pink, small; cobs white.

Origin. This line was developed at the Kansas Agricultural Experiment Station from the variety Yellow Selection No. 1, which is a yellow selection of Pride of Saline.

Agronomic characteristics. This line produces single cross plants of exceptionally thick stalks.

22. K4

Description. Plants early to midearly germinating, lacking early vigor, late, short; culms reddish, small to midlarge, short to midlong internodes; nodes not prominent, 23 total, 13-14 above ground, 9-10 below ground; brace roots on first node above ground or none; suckers none; leaves short, mid-

wide to wide, dark green, little or no wrinkling (on some younger leaf margins and scattered throughout the rest of the blade), not rigid, spreading, little to no creasing lengthwise, very wavy, little to no striping, heavily pubescent on upper leaf surface; leaf curl 1-2 leafed, midopen; ligule 2-3 mm high; edges of leaf sheath pilose; collar pubescent to puberulent; tassel type 3a but may appear to be 1a in some cases due to enclosure of lower tassel branches in upper leaf sheath, about 26-28 cm long; peduncle midlarge to large; central spike exceeding lateral branches 3-(4)-6 cm, 15-(17)-19 cm long; lateral branches 12-(15)-15 cm long, 20-(24)-27 in number, about one-half the length of the tassel, middense, inner side of rachis partly bare; lower spikelet nearly sessile; pedicel of upper spikelet 4-6 mm long; glumes red and white between greenish nerves; first glume about 10 mm long, about 4 mm wide, 10 nerved on upper spikelet and 8 nerved on lower spikelet; second glume 9-10 mm long, about 4 mm wide, 9-10 nerved on upper spikelet and 5 nerved on lower spikelet; lemma 7-8 mm long, 5 nerves converging at summit; palea about 6 mm long; anthers yellowish green and red; styles green; stigmas green; ear cylindrical, midlong, on seventh or eighth node above ground, considerably less than one-half way up on culm, 16 kernel rows; kernels yellow, small; cobs very dark red.

Origin. This line was developed by the Kansas Agricultural Experiment Station from the variety Kansas Sunflower.

Agronomic characteristics. This line is 2-eared and free from rots.

23. C

Description. Plants midearly germinating, medium vigor, late, midtall; culm green, midlarge, midlong internodes; nodes little if any larger than culm, 22-23 total, 14 above ground, 8-9 below ground; brace roots on first and second nodes above ground or none; suckers none; leaves midlong, wide, light to me-

dium green becoming a whitish green under dry conditions, some wrinkling on blade with lower margins heavily wrinkled, nonrigid, spreading, little creasing lengthwise, not wavy to midwavy, not striped; heavily pubescent; leaf curl 2 leaved, open; ligule 3-4 mm high; edges of leaf sheath puberulent to pubescent; collar puberulent; tassel type 1a, 32-(36)-39 cm long; peduncle mid-large to large; central spike exceeding lateral branches 7-(9)-10 cm, 19-(22)-24 cm long; lateral branches 12-(15)-19 cm long, 14-(18)-22 in number, less than one-half length of tassel, middense, inner side of rachis bare to partly covered; lower spikelet pedicellate, pedicel mostly 2 mm long; pedicel of upper spikelet 3-(5)-6 mm long; glumes mostly white between greenish nerves, red and white edges; first glume 9-10 mm long, 3-4 mm wide, 9 nerved; second glume 8-9 mm long, 4 mm wide, 9 nerved; lemma 6-7 mm long, 5 nerves converging at summit, tip ciliate; palea 5-6 mm long, tip ciliate; anthers yellowish green; styles green; stigmas red; ear midlong, cylindrical, on ninth node above ground, about one-half way up on culm, 20 kernel rows; kernels reddish yellow with yellow caps, midlarge; cobs dark red.

Origin. The parent variety is Mastadon. This line was developed at the Missouri Agricultural Experiment Station. It is used in Mo. 8 and 47. Kansas and Missouri use this inbred to a large extent.

Agonomic characteristics. This line is 2-eared, smut susceptible, an excellent pollen producer, and has a poor root system.

Synonyms. It is known as Mo. G, Cigas, G, and Mo. Cigas.

24. L3

Description. Plants midearly germinating, vigorous, midseason, midtall to tall; culm reddish green, small to midlarge, midlong internodes; nodes not prominent, 20 total, 14 above ground, 6 below ground; brace roots on first

node above ground or none; suckers few to none; leaves midlong, midwide, dark green, little or mostly no wrinkling, semirigid, ascending to spreading, little creasing lengthwise, not wavy, little striping but may appear so under some light conditions; leaf curl 2 leafed, midopen; ligule 4-5 mm high; edges of leaf sheath antrorsely pilose; collar pubescent to pilose; tassel type 1b, 25-(30)-33 cm long; peduncle small; central spike exceeding lateral branches mostly 6-8 cm, 19-(21)-24 cm long; lateral branches 11-(13)-16 cm long, 12-(16)-21 in number, less than one-half length of tassel, middense, inner side of rachis bare; lower spikelet pedicellate, pedicel mostly 1 mm long; pedicel of upper spikelet 2-(2)-4 mm long; glumes mostly white between greenish nerves, white and red edges; first glume 9-10 mm long, 3 mm wide, 10 nerved; second glume 6-9 mm long, 4 mm wide, 8 nerved; lemma 7-8 mm long, 3 nerves indistinct and converging at summit; palea 5-6 mm long; anthers yellowish green and red; styles green; stigmas green; ear cylindrical, long, on ninth node above ground, more than one-half way up on culm, 12-14 kernel rows; kernels light yellow, round, small; cobs red.

Origin. This line is a recovered line from L317 and was developed at the Missouri Agricultural Experiment Station. It is used in Kansas and Missouri in the hybrids No. 8 and 47.

Agronomic characteristics. This line is a poor pollen producer, heat and drought resistant and the kernels often crack at maturity.

Synonyms. It is very closely related to L317.

25. Oh31

Description. Plants vigorous, early, midtall; culms green, midlarge, midlong internodes; nodes not prominent, 20-21 total, 12-14 above ground, 7-8 below ground; brace roots on first node above ground or none; suckers few to

many; leaves short to midlong, narrow to midwide, medium green, little wrinkling, not rigid, spreading, no creasing lengthwise, midwavy, not striped; ligule 2-3 mm high; edges of leaf sheath pilose to villous; collar puberulent to pubescent; tassel type 2a, 30-36 cm long; peduncle small to midlarge; central spike exceeding lateral branches 9-12 cm, 22-(25)-29 cm long; lateral branches 12-16 cm long, 9-(12)-15 in number, less than one-half length of tassel, middense, inner side of rachis bare; lower spikelet sessile; pedicel of upper spikelet 2-(3)-5 mm long; glumes usually white between greenish nerves, white and red in edges; first glume 9-10 mm long, 5-4 mm wide, 11-13 nerved; second glume 8-9 mm long, 4 mm wide, 9 nerved; lemma 7-8 mm long, 5 nerves converging at summit; palea 5-6 mm long; anthers mostly yellowish green; styles light red; stigmas light red; ear on seventh node above ground, over one-third of way up on culm, 12 kernel rows; kernels golden yellow, small; cobs red.

Origin. The parent variety is Early Clarence. It was developed at the Ohio Agricultural Experiment Station. This line combines well with Ry, 701, etc. It looks promising for northern Illinois, and Ohio.

Agonomic characteristics. This line contributes smut resistance, ear quality, and yield quality. It is two-eared and has a poor root system.

26. U.S. 1

Description. Plants midearly germinating, vigorous, midseason to late, tall; culm green, large, midlong to long internodes; nodes prominent, 22 total, 13-14 above ground, 8-9 below ground; brace roots on first and second nodes above ground; suckers none; leaves midlong to long, wide, light to medium green, wrinkled on lower parts of blades and margins of some leaf tips, semi-rigid, ascending to spreading, creased lengthwise, very wavy, little or no striping; leaf curl 2 leafed, midopen; ligule 3-4 mm high; edges of leaf sheath pilose; collar pubescent to pilose; tassel type 2a, 34-40 cm long; peduncle mid-

large to large; central spike exceeding lateral branches 6-(8)-10 cm, 25-(26)-29 cm long; lateral branches 16-(19)-21 cm long, 13-(18)-22 in number, about one-half length of tassel, middense, inner side of rachis bare; lower spikelet pedicellate, pedicel mostly 2 mm long; pedicel of upper spikelet 5-(6)-8 mm long; glumes mostly white between greenish nerves; first glume 9-10 mm long, 3-4 mm wide, 7-8 nerved; second glume 9-10 mm long, 5-4 mm wide, 7-8 nerved; lemma 8-9 mm long, 3-5 parallel nerves and not converging at tip; palea 5-7 mm long; anthers about 3 mm long, reddish, not deciduous; styles red; stigmas red; ears on eight node above ground, a little less than one-half way up on culm, 18 kernel rows; kernels yellow, large; cobs white.

Origin. This line was developed by the Bureau of Plant Industry. It is a composite of the following (11b x 6-5)-3₁-3₂-1-4-2-1-(x).

27. U.S. 2

Description. Plants midearly germinating, vigorous, midseason, midtall to tall; culms green to reddish green, midlarge, midlong internodes; nodes not prominent, 21-22 total, 13-14 above ground, 8 below ground; brace roots on first node above ground or none; suckers none; leaves midlong to long, midwide, medium green to dark green, some wrinkling on lower parts of some blades and on margins of some of the younger blades, semirigid, ascending to spreading, little creasing lengthwise, not wavy, not striped; leaf curl 1-2 leafed, midopen; ligule 2-3 mm high; edges of leaf sheath pubescent; collar puberulent to pubescent; tassel type 1a but variable, length 35-45 cm; peduncle midlarge; central spike exceeding lateral branches 9-13 cm, 23-32 cm long; lateral branches 17-24 cm long, 8-(9)-14 in number, about one-half length of tassel, dense, inner side of rachis almost entirely covered; spikelets deciduous after pollen shedding and disarticulating below glumes leaving rachis bare; lower spikelet sessile or nearly so;

pedicel of upper spikelet 3-(5)-5 mm long; glumes mostly white between greenish nerves, reddish brown and white edges; first glume 10-11 mm long, 4 mm wide, 8-9 nerved; second glume 9-10 mm long, 4 mm wide, 7-8 nerved; lemma 7-9 mm long, 3 nerves converging at summit; palea 5-7 mm long; anthers yellowish green; styles green; stigmas green; ears on eighth node above ground, about one-third way up on culm 12 kernel rows; kernels light yellow, midlarge; cobs red.

Origin. This line was developed by the Bureau of Plant Industry. It is a composite of the following; (23 x 4-3d)-E₁-3₁-1-2-1-1-(x).

23. U.S. 3

Description. Plants midearly germinating, vigorous, midseason, midtall; culm reddish, small to midlarge, midlong internodes; nodes not prominent, 21 total, 14 above ground, 7 below ground; brace roots on first two nodes above ground; suckers none; leaves short to midlong, midwide to wide, dark green, heavily wrinkled throughout, semirigid, ascending, little creasing lengthwise, very wavy, little to no striping; leaf curl 1-2 leafed, midopen to open; ligule 2-3 mm high; edges of leaf sheath pilose; some of upper leaf sheaths closed; collar puberulent; tassel type 1a, 27-(30)-36 cm long, a purplish cast at the time of pollen shedding, later becoming darker; peduncle midlarge; central spike exceeding lateral branches 4-(6)-8 cm, 16-(19)-23 cm long; lateral branches 14-17 cm long, 16-24 in number, about one-half length of tassel, mid-dense to dense, inner side of rachis partly covered; lower spikelet mostly sessile, a few pedicellate; pedicel of upper spikelet 3-(4)-5 mm long; glumes white and purple between greenish nerves, reddish glume edges; first glume 10-11 mm long, about 5 mm wide, 12 nerved; second glume 9-10 mm long, 5 mm wide, 8-9 nerved; lemma 8-9 mm long, 4-5 nerves converging at summit; palea 6-7 mm long; anthers yellowish green; styles green; stigmas red; ear cylindri-

cal, midlong, on ninth node above ground, about one-half way up on culm, 14-16 kernel rows; kernels light yellow, midlarge; cobs red.

Origin. This line was developed by the Bureau of Plant Industry. It is a composite of the following: (24 x 340)-B₁-S₁-2-1-1-5-(x).

29. U.S. 5

Description. Plants midearly germinating, vigorous, midseason, midtall to tall; culm green to reddish green, midlarge to large, midlong to long internodes; nodes not prominent, 21 total, 14 above ground, 7 below ground; brace roots on first and second nodes above ground; suckers none; leaves midlong, midwide, medium green, little wrinkled on lower parts of blade, not rigid, spreading, little to no creasing lengthwise, very wavy, partly striped; leaf curl 2-3 leafed, mid-open; ligule 3-4 mm high; edges of leaf sheath pilose; collar puberulent to pubescent; tassel type 3a, 35-39 cm long; peduncle small to midlarge; central spike exceeding lateral branches 9-(10)-14 cm, 24-30 cm long; lateral branches 13-19 cm long, 11-19 in number, less than one-half length of tassel, lax to middense, inner side of rachis bare; lower spikelet pedicellate, pedicel mostly 2 mm long; pedicel of upper spikelet 3-(5)-6 mm long; glumes mostly white between greenish nerves; first glume 10-11 mm long, about 5 mm wide, 10 nerved, small reddish tip only noticeable on green unblasted glume at the time of pollen shedding; second glume 9-10 mm long, 5 mm wide, 9 nerved; lemma 8-9 mm long, 3 parallel nerves, not converging at summit; pales 6-7 mm long; anthers yellowish green; styles red; stigmas red; ear cylindrical, midlong, on eighth node above ground, about one-half way up on culm, 10-12 kernel rows; kernels very light yellow, midlarge; cobs white.

Origin. This line was developed by the Bureau of Plant Industry. It is the composite of the following: (41 x 461-3)-B₁-S₁₀-1-2-1-3-(x).

30. U.S. 6

Description. Plants midearly germinating, vigorous, midseason to late, midtall to tall; culm reddish green, midlarge to large, midlong to long internodes; nodes not prominent, 21-22 total, 14-15 above ground, 7 below ground; brace roots on first two nodes above ground or none; suckers none; leaves midlong, midwide to wide, light to medium green, wrinkling mostly on margins, not rigid, spreading, little creasing lengthwise, midwavy to wavy, distinctly striped, striping does not disappear with age, sparsely pubescent; leaf curl 2-3 leafed, midopen to open; ligule 5-6 mm high; edges of leaf sheath pilose; collar puberulent to pubescent; tassel type mostly 1a and some 1b, 21-44 cm long; peduncle midlarge to large; central spike exceeding lateral branches 7-11 cm, 21-29 cm long; lateral branches 15-22 cm long, 17-(20)-25 in number, less than one-half length of tassel, middense, inner side of rachis bare; lower spikelet sessile or nearly so; pedicel of upper spikelet 3-(4)-5 mm long; glumes usually white between greenish nerves, red and white edges; first glume 9-10 mm long, 3-4 mm wide, 9 nerved; second glume 3-9 mm long, about 4 mm wide, 6 nerved; lemma 7 mm long, 3 nerves converging at summit, ciliate tip; palea 6 mm long; anthers yellowish green with some red; styles green; stigmas green; ear on eighth node above ground, less than one-half way up on culm, 10-12 kernel rows; kernels dark yellow with light yellow caps; cobs red.

Origin. This line was developed by the Bureau of Plant Industry. It is a composite of the following: (61 x 67)-B₁-S₂-1-2-3-1-(x).

31. U.S. 7

Description. Plants midearly germinating, very vigorous, midseason to late, tall; culm reddish green, midlarge, midlong internodes; nodes slightly

larger than culm, 22 total, 15 above ground, 7 below ground; brace roots on first or second nodes above ground; suckers none; leaves long, midwide, dark green, very little wrinkling which is on lower leaf blade margins, semirigid, spreading, little creasing lengthwise, very little waviness, not striped; leaf curl 2 leafed, midopen to open; ligule 4-5 mm high; edges of leaf sheath pilose; collar puberulent and sparsely pilose; tassel type mostly 1b with some 1c, 29-(35)-41 cm long; peduncle small to midlarge; central spike exceeding lateral branches 4-(5)-9 cm, 21-(25)-30 cm long; lateral branches 17-(20)-24 cm long, 8-14 in number, more than one-half length of tassel, lax to middense, inner side of rachis bare; lower spikelet pedicellate, pedicel mostly 1 mm long; pedicel of upper spikelet 5-(6)-8 mm long; glumes usually white between greenish nerves, reddish bases, although no definite ring there is a tendency for one; first glume 8-9 mm long about 4 mm wide, 12 nerved; second glume 8 mm long, about 4 mm wide, 9 nerved; lemma 6-7 mm long; 2 nerves converging at summit; palea 4-5 mm long; anthers yellowish green, on very small flattened filaments; styles green; stigmas green; ear short, cylindrical, on ninth node above ground, about one-half way up on culm, 12-14 kernel rows; kernels deep yellow, yellow caps, midlarge; cobs white.

Origin. This line was developed by the Bureau of Plant Industry. It is from the following: (J.C. 33 x L517)-B-B-3₁-2-3-(x) composite. It is a yellow J.C. 33 with an increment of L517.

32. U.S. 187-2

Description. Plants midearly germinating, weak in earlier stages of growth, midseason, midtall; culm green to reddish green, midlarge, short to midlong internodes; nodes not prominent, 21 total, 12-13 above ground, 8-9 below ground; brace roots on 3-4 nodes above ground; suckers none; leaves short,

midwide, dark green, very little wrinkling, semirigid, ascending, creased lengthwise, very wavy, very little striping; leaf curl 2-3 leafed, closed and flattened opening; ligule 2-3 mm high; edges of leaf sheath pilose; collar pubescent to pilose; tassel type 1a, 29-(31)-33 cm long; peduncle midlarge to large; central spike exceeding lateral branches 8-11 cm, 21-(23)-27 cm long; lateral branches 12-(14)-16 cm long, 8-(11)-14 in number, less than one-half length of tassel, middense to dense, inner side of rachis bare; lower spikelet nearly sessile; pedicel of upper spikelet 4-6 mm long; glumes mostly white between greenish nerves, red and white edges; first glume 9-10 mm long, about 4 mm wide, upper 13 nerved, lower 11 nerved; second glume 8-9 mm long, about 3 mm wide, upper 13 nerved and lower 9 nerved; lemma 7-8 mm long, 5-6 nerves converging at summit; palea 5-6 mm long; anthers yellowish green; styles green; stigmas green; ear on sixth or seventh node above the ground, more than one-third way up on culm; kernels dull yellow, small; cobs red.

Origin. The parent variety is Krug. U.S. 187-2 is a strain of Mr. Lester Pfister's 187-2. It was selected at the Arlington Experiment Farm, Arlington, Virginia by the Bureau of Plant Industry from an ear supplied by Mr. Pfister in September, 1930, at which time it had been selfed for six generations. It is used throughout the corn belt.

Agromomic characteristics. This line is stiff stalked, a good pollinator, sets seed well, contributes lodging resistance and good yields, and has variable plant quality. The young seedlings are somewhat susceptible to "wet feet".

33. U.S. 4-8

Description. Plants early to midearly germinating, very vigorous, mid-season, midtall; culms green to reddish green, midlarge, short to midlong internodes; nodes not prominent, 21 total, 13-14 above ground, 7-8 below ground;

brace roots on first node or none; suckers few to none; leaves long, midwide, medium green, medium to heavily wrinkled, the wrinkles more like bulges and throughout the blade, not rigid, spreading, creased lengthwise, little to no waviness, very little striping; leaf curl 3 leafed, midopen; ligule 3-4 mm high; edges of leaf sheath pubescent to pilose; collar puberulent; tassel type 2b, 35-(39)-43 cm long; peduncle small to midlarge; central spike exceeding lateral branches 10-15 cm, 21-(27)-32 cm long; lateral branches 13-(16)-18 cm long, 8-15 in number, less than one-half length of tassel, mid-dense, inner side of rachis bare; lower spikelet sessile or nearly so; pedicel of upper spikelet 3-5 mm long; glumes usually white between greenish nerves, reddish brown edges; first glume 11-12 mm long, 4-5 mm wide, 15 nerved; second glume 10-11 mm long, about 5 mm wide, 9 nerved; lemma 8-9 mm long, 3 parallel nerves, not converging at summit; palea 6-7 mm long; anthers yellowish green; styles green; stigmas green; ear rather long, on seventh node above ground, less than one-third way up on culm, 10 kernel rows; kernels golden yellow, small to midlarge; cobs red.

Origin. The parent variety is Lancaster Surecrop. This line was developed by the Bureau of Plant Industry.

Agronomic characteristics. This line stands fairly well and has a strong root system but the stalks tend to break after maturity. It is an excellent pollinator and good seed setter under the best conditions but very susceptible to adverse conditions and has fair grain quality.

EXPLANATION OF PLATE II

Inbred lines of corn

1. B4.
2. Hy.
3. B2.
4. J.C. 33.

PLATE II



EXPLANATION OF PLATE III

Inbred lines of corn

5. 38-11.

6. WF9.

7. Tr.

8. 1205.

PLATE III



EXPLANATION OF PLATE IV

Inbred lines of corn

9. I224.
10. I234.
11. I239.
12. I317.

PLATE IV



EXPLANATION OF PLATE V

Inbred lines of corn

13. B1345.
14. B1349.
15. Mc401.
16. Os420.

PLATE V



EXPLANATION OF PLATE VI

Inbred lines of corn

- 17. Os426.
- 18. Cl447.
- 19. IT701.
- 20. Kr(0af).

PLATE VI



EXPLANATION OF PLATE VII

Inbred lines of corn

21. Kys.

22. K4.

23. G.

24. L3.

PLATE VII



EXPLANATION OF PLATE VIII

Inbred lines of corn

25. Oh51.

26. U.S. 1.

27. U.S. 2.

28. U.S. 3.

PLATE VIII



EXPLANATION OF PLATE IX

Inbred lines of corn

29. U.S. 5.

30. U.S. 6.

31. U.S. 7.

32. U.S. 167-2.

33. U.S. 4-8.

PLATE IX



SUMMARY AND CONCLUSIONS

A study of thirty-three commercially important inbred lines of corn was made in preparing this classification for inbred lines. Data were collected from a field planting of two replications during the growing season of corn in 1940. These data were checked with a planting of most of the lines in an irrigated nursery. The kernel and ear characters were taken from ears grown in the irrigated nursery or from seed samples.

A total of sixty characters was recorded on each line. These included some of the cula, leaf, tassel, spikelet, silk, ear, kernel, cob, and other plant characters. These characters represent only a few of the contrasting characters found in inbred lines of corn. Most of the taxonomic characters were divided into three relative classes, viz., the two extremes and a center class.

From these data, three different keys were prepared. These are the vegetative key, the supplementary vegetative key and the mature plant key for inbred lines of corn. The vegetative key to inbreds makes use of leaf characters to a considerable extent. The purpose of this key is for the identification of lines before the time of pollen shedding. This would prove useful in the reguing of detasseling plots. It would also be a valuable aid to the hybrid corn inspector in the inspection of such plots before the time of tasseling. The supplementary vegetative key is constructed in the form of a table. Its purpose is not to replace the vegetative key but rather to supplement it. Sixteen characters were used to compose this key. The characters used represent the extremes or the outstanding and readily distinguishable ones; the intermediates were not given.

The mature plant key makes use of those tassel and ear characters which allow for the greatest contrast and are readily apparent. These are given primary importance and are used in regular order. When necessary, minor characters are used to bring out differences between lines that are very similar. Recovered and second cycle lines fall into this group. Such a group may have to be distinguished mostly on agronomic characteristics.

The description, origin, agronomic characteristics and in some instances synonyms are given for each of the inbred lines used in this study. A uniform plan was followed in reporting this information, i.e., general plant characters always precede culm characters, central spike characters precede tassel branch characters and so on. The description is given first; this is followed by the origin and then the agronomic characteristics. If there are any synonyms, they are given last.

A definite identification of a line would obviate the necessity of the secrecy surrounding the pedigree of a hybrid. This classification would also be very helpful to the inspector of detasseling plots. Furthermore, such a classification would do much to standardize and simplify the nomenclature of inbred lines.

As a result of this study, it is concluded that inbred lines of corn can be definitely identified on their morphological characters. Such a classification and description has much practical value for the corn worker and it further increases the knowledge of the corn plant. This appears to be the first classification of inbred lines of corn.

GLOSSARY

Antorse. Directed upwards or forward; opposed to retrorse.

Brace roots. Roots that arise from the first nodes above the surface of the ground; also called prop, brace or aerial roots.

Blade. The part of the leaf beyond the sheath.

Ciliate. The margin fringed with hairs.

Central spike. The continuation of the culm upon which there are usually four to eleven rows of paired spikelets; a part of the tassel.

Collar. That part of the leaf at the junction of the sheath and the blade.

Culm. The jointed stem of the corn stalk and also of all grasses.

Deciduous. Falling off or subject to fall; as applied to spikelets which fall off as maturity approaches.

Filament. The stalk of the stamen.

Fimbriate. Hairs rather long and making a fringe, like an eye-lash.

Floret. The lemma and palea with the included flower (the stamens and the pistil).

Glabrous. Smooth, having no hairs or bristles.

Glabrate. Few scattered hairs when young, which break off as the plant ages.

Glaucous. Covered with a fine whitish waxy bloom which rubs off.

Glumes. The pair of bracts at the base of the spikelet.

Hirsute. Long straight rather stiff hairs.

Hyaline. Transparent or nearly so.

Lemma. The bract of a spikelet just above the glumes.

Ligule. The thin appendage on the upper side of a leaf at the junction of the blade and the sheath.

Membranous, membranaceous. With the texture of a membrane; thin and more or less translucent.

Nerve. A vascular vein of the blade, glume, lemma or palea.

Palea. The inner or upper bract on a floret.

Pectinate. Pinnately divided into close divisions, or comblike.

Pedical. The stalk of a spikelet.

Pedicellate. Having a pedicel as opposed to sessile.

Peduncle. The stalk or stem supporting the staminate inflorescence.

Pilose. Long, soft and fairly straight hairs.

Puberulent. Diminutive of pubescent; extra short, soft hairs.

Pubescence. Any hairy covering.

Pubescent. Short, soft hairs.

Rachis. The axis of a spike or raceme, of the tassel branches, and of the central spike as applied here.

Sessile. Lacking a pedicel or stalk; opposed to pedicellate.

Sheath. The lower part of a leaf that encloses the stem or culm.

Spikelet. The unit of inflorescences in grasses, consisting of the two glumes and one or more florets.

Stamen. The part of the flower that bears the pollen.

Stigma. As applied here it refers to the stigmatic hairs on the silks.

Style. Refers to the long silks in corn, excluding the hairs.

Suckers. Secondary stems or branches arising from the lower nodes; also called tillers.

Tassel. The paniculate inflorescence at the tip of the culm of corn; the staminate inflorescence.

Villous or villose. Long, soft, shaggy hairs.

Tassel or lateral branches. The branches of the tassel that arise from the central axis in a spiral-like manner; usually two rows of paired spikelets.

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LITERATURE CITED

- Bryan, A. A. and Jegenheimer, H. W.
Hybrid corn in Iowa. Iowa Agr. Expt. Sta. Bul. 366. 38 p. 1937.
- Clark, J. A. and Bayles, B. B.
Classification of wheat varieties grown in the United States. U. S. Dept. Agr. Tech. Bul. 459. 164 p. 1935.
- Copple, R. F. and Aldous, A. E.
The identification of certain native and naturalized grasses by their vegetative characters. Kans. Agr. Expt. Sta. Tech. Bul. 32. 73 p. 1932.
- Emerson, R. A., Beadle, G. W. and Fraser, A. C.
A summary of linkage studies in maize. Cornell Memoir 180. 83 p. 1935.
- Eyster, W. E.
Genetics of Zea mays. Bibliographia Genetica, 11:187-392. 1934.
- Hitchcock, A. S.
Manual of grasses of the United States. U. S. Dept. Agr. Misc. Pub. 800. 1040 p. 1935.
- Hitchcock, C. L.
A key to the grasses of Montana based upon vegetative characters. Chicago. John B. Swift Co. Inc. 1937.
- Jenkins, M. T.
Report of the Second Corn Improvement Conference, Madison, Wisconsin, Washington, D. C., U. S. Dept. Agr. (Mimeo.). 53 p. 1938.
- Keim, F. D., Beadle, G. W., and Frolik, A. L.
The identification of the more important prairie hay grasses of Nebraska by their vegetative characters. Nebr. Agr. Expt. Sta. Res. Bul. 65. 40 p. 1932.
- Leonard, W. H.
Crop production under semi-arid conditions. Colo. State College. (Mimeo.). 171 p. 1933.
-
- Advanced farm crops. Fort Collins, Colo. State College. (Mimeo.). 152 p. 1937.
- Nowosad, F. S., Swales, D. E. W., and Dore, W. G.
The identification of certain native and naturalized hay and pasture grasses by their vegetative characters. Macdonald College Tech. Bul. 16. 75 p. 1936.

Robbins, W. W.

The botany of crop plants. Philadelphia. P. Blakiston's Son and Co.
639 p. 1931.

Sturtevant, E. L.

Varieties of corn. U. S. Dept. Agr. Bul. 57. 103 p. 1899.

Vinall, H. N., Stephens, J. C., and Martin, J. H.

Identification, history, and distribution of common sorghum varieties.
U. S. Dept. Agr. Tech. Bul. 506. 101 p. 1936.

Weatherwax, Paul.

The story of the maize plant. Chicago. University of Chicago Press.
247 p. 1923.

Robbins, W. W.

The botany of crop plants. Philadelphia. P. Blakiston's Son and Co.
639 p. 1931.

Sturtevant, E. L.

Varieties of corn. U. S. Dept. Agr. Bul. 57. 103 p. 1899.

Vinall, H. N., Stephens, J. C., and Martin, J. H.

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247 p. 1923.