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OAT IDENTIFICATION AND CLASSIFICATION

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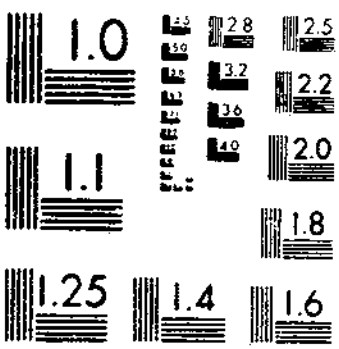

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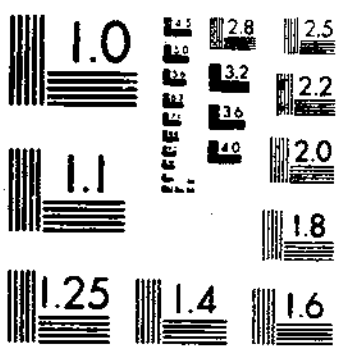

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Oat Identification and Classification

By

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Oat Identification and Classification[1]

By T. R. STANTON, formerly *senior agronomist, Field Crops Research Branch, Agricultural Research Service*[2]

INTRODUCTION

The application of different names to a thousand or more strains of oats that represent a much smaller number of distinct varietal types has resulted in much confusion of oat varieties and varietal nomenclature in the United States. Consequently, there is a definite need for information on the origin, identification, classification, distribution, and economic importance of varieties and their synonymous strains. The introduction and distribution of many varieties from foreign countries and also the development and distribution of numerous improved strains by selection and hybridization have served to complicate the problem further. However, the rapid dissemination and increase in commercial production of these improved varieties since about 1930 have greatly reduced the practice of renaming and marketing old commercial varieties of oats or mixtures of them. This has simplified the identification and classification of new varieties, especially those now of agricultural importance. Another recent favorable development is that most commercial seedsmen are now advertising and selling seed of the improved varieties recommended by State and Federal agricultural experiment stations and extension services.

In 1916, when Etheridge (*61*)[3] published his classification of the varieties of cultivated oats, certain established morphological varieties were known by numerous names, and frequently the same popular varietal name was applied to several different and distinct morphological types. Since that time, however, the number of named strains of many varietal types has been greatly reduced. Furthermore, there are now considerably fewer varietal types that would rate some economic importance.

Heretofore, practically all taxonomic writers have emphasized principally the purely botanical characters for the identification of oat varieties. Among cereal breeders, agronomists, and seed growers there is a demand for a classification that also considers the agronomic, physiologic, and pathologic characters. These latter attributes largely determine the extent of the culture and distribution of a variety, as well as aid in its identification. This has been particularly true in recent years when disease re-

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[2] Credit is due the late L. C. Burnett at Ames, Iowa; R. W. Smith at Dickinson, N. Dak.; Loren L. Davis, Harland Stevens, and G. A. Wiebe at Aberdeen, Idaho, for sowing and growing classification nurseries; Mrs. Regina O. Hughes, Forage and Range Section, for the color drawings; and J. H. Martin, Cereal Crops Section, for assistance in the preparation and editing of the manuscript.

[3] Italic numbers in parentheses refer to Literature Cited, p. 193.

sistance has become the most important factor in determining the choice of varieties.

Of the small grains, oats are the most difficult to classify satisfactorily. The principal distinguishing characters between the several more or less distinct groups of cultivated varieties are well known and readily recognizable. Nevertheless, owing to similarity in many of the minor characters, confusion usually arises after a separation has been made on the basis of color of matured lemma (grain). The environmental, or place effect, also is great in oats, thus making certain characters of doubtful value for the purpose of classification when varieties are grown under a wide range of soil and climatic conditions.

Prior to about 1930, hundreds of named strains have been listed in seed catalogs as distinct new varieties. Unfortunately, a high percentage of these so-called new varieties has come into existence simply by applying new names to old varieties. Some of these, however, are distinct physiologically and on the basis of performance must be considered as definite agricultural varieties.

This bulletin contains the description, history, distribution, and synonomy of the botanical and agricultural varieties of oats grown commercially. Also described are certain varieties of known, or potential, plant-breeding and taxonomic value that are grown and recognized primarily by agricultural experiment stations and other research institutions.

Of the cereal grains, oats are exceeded in economic importance only by corn and wheat in the United States. In each of several years of the decade of the 1940's, the crop attained a production of nearly 1½ billion bushels. The distribution of oats in the United States in 1949 is shown in figure 1.

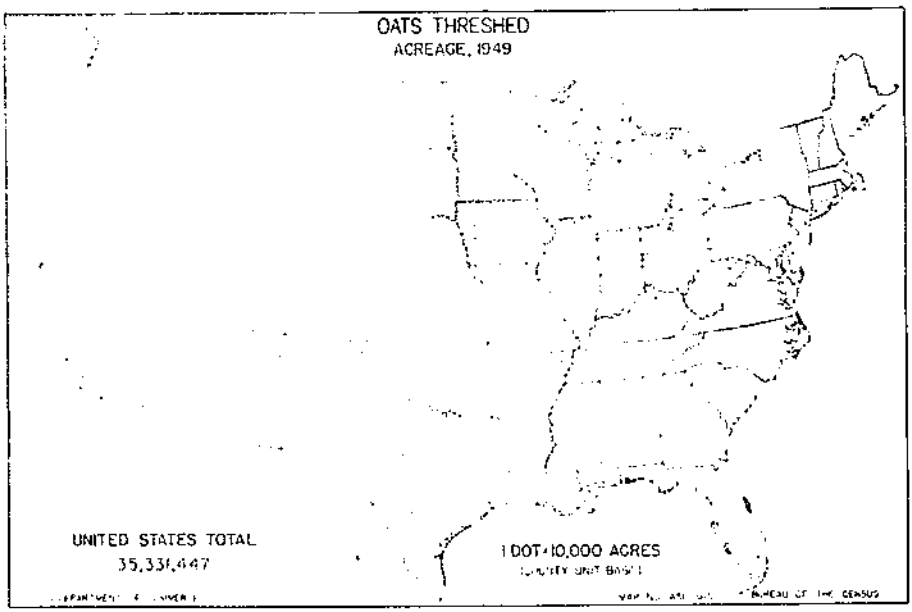

FIGURE 1. Distribution of oats in the United States in 1949, based on acreage.

PREVIOUS INVESTIGATIONS

A complete review of literature on the classification of oat species and varieties is not essential for this study. Most of the systematic studies of the species of *Avena* have been conducted in other countries. Except for the classification of Etheridge (*61*), no comprehensive investigation of this nature has been reported in America. Numerous publications of the State agricultural experiment stations, the United States Department of Agriculture, and the Dominion of Canada Department of Agriculture describe the characters of the oat varieties grown in particular regions and States. Most of the foreign classifications are primarily of species rather than of varieties. Since only the varieties of two species, namely *Avena byzantina* C. Koch, and *A. sativa* L., including the two subspecies *A. sativa diffusa* (Niels.) Asch. & Graeb. and *A. sativa orientalis* Schreb., are of much economic importance in the United States or in most other countries, those studies that have dealt particularly with the separation of the more distinct varieties within these groups will be reviewed. The results of investigations dealing chiefly with the origin, ecology, and classification of the wild and so-called minor oat species will be treated less extensively.

The literature on the identification, classification, and description of oat varieties as well as the few more comprehensive and distinct, recently published, foreign studies in which the classification of agricultural varieties is the major objective, is reviewed briefly in chronological order.

Devol, of the Ohio Agricultural Experiment Station, Wooster, in 1887 (*52, pp. 65–81*), grouped the 51 oat varieties then under experiment at that station in accordance with the following characters: (1) Hulled or naked, (2) form of panicle, (3) color of kernel, and (4) form and size of kernel. Brief descriptions of each variety also were presented. This was one of the earliest attempts to classify systematically the cultivated oats of this country.

Hickman, in 1892 (*76, pp. 7–8*), divided the oat varieties grown at the Ohio Agricultural Experiment Station, Wooster, into four groups, namely, (1) Welcome, (2) Seizure, (3) Wideawake, and (4) mixed. These groups, however, were not well defined and were only tentative.

Morrow and Gardner, in 1894 (*110*), classified the 17 oat varieties then under test at the Illinois Agricultural Experiment Station, Urbana, on the basis of time of maturity, panicle form, and color and size of kernel.

Duggar, in 1906 (*54, pp. 68–70*), described five standard southern oat varieties under experiment at the Alabama Agricultural Experiment Station, Auburn.

Willis, in 1908 (*210*), presented general information on the origin and agronomic characters of 19 varieties of oats grown in varietal experiments at the South Dakota Agricultural Experiment Station, Brookings.

Carleton, in 1910 (*25, pp. 7–8*), gave the origin and description of Swedish Select oats that he had introduced from Russia for the United States Department of Agriculture.

Warburton, in 1911 (*204*), published rather complete general descriptions of the few principal varieties of oats grown from fall seeding in the South.

Hunt, in 1912 (*83, pp. 285–291*), discussed some of the oat varieties grown in America and gave brief

historical and descriptive notes on six introduced varieties.

Burnett, in 1912 (*16*), presented a synopsis of a classification of 16 distinct varietal types that were grouped in accordance with the outstanding botanical and agricultural characters. A classification of oat varieties for show purposes was appended to this publication.

Duggar and Cauthen, in 1913 (*56, pp. 133–134*), presented general descriptions of the principal varieties of fall-sown oats under experiment at that time at the Alabama Agricultural Experiment Station, Auburn.

Warburton, in 1914 (*205*), published notes particularly on the derivation and classification of the one principal cultivated species of red oats, varieties of which are grown in the South.

Surface and Barber, in 1914 (*184, pp. 150–158*), presented a key to the 34 oat varieties grown in experiments at the Maine Agricultural Experiment Station, Orono. In that classification, the varieties were grouped in accordance with some of the most obvious taxonomic characters.

Clark, in 1914 (*29, pp. 27–30*), recorded brief notes on the origin and description of the Early Mountain, Golden Rain, and Victory oat varieties then being grown at Dickinson Substation, Dickinson, N. Dak.

Hume and Champlin, in 1914 (*82*), classified the leading varieties of oats grown in South Dakota on the basis of a few major taxonomic characters. Brief general descriptions and histories of varieties also are given.

Snowden, in 1915 (*146*), presented brief histories and some general descriptive matter on the varieties of oats grown in Louisiana.

Schafer and Gaines, in 1916 (*140*), recorded general descriptions and, in some cases, the origins of 14 of the 26 commercial varieties of oats that were under experiment at the Washington Agricultural Experiment Station, Pullman, at that time.

Childs, in 1916 (*28*), gave brief general descriptions of the six more or less distinct varietal types of oats grown from fall seeding in experiments by the Georgia State College of Agriculture, Athens.

Hills, in 1916 (*78*), gave a practical discussion of the seven distinct botanical groups of oats from the standpoint of their value for Vermont.

Carleton, in 1916 (*26, pp. 95–104*), suggested the following outline, based largely on the work of Schulz (*143*) and Schulz-Halle (*144*), after an extensive review of literature, as being the nearest correct classification of the wild species and their cultivated derivatives:

Avena	*fatua* L.	*sativa* L.	Common, or spreading, oats.
		orientalis Schreb.	Side oats.
		nuda L.	Hull-less oats.
	sterilis L.	*algeriensis* Trab.	Red, or Algerian, oats.
	barbata Brot.	*strigosa* Schreb.	Rough, or sand, oats.
		brevis Roth	Short oats.
	wiestii Steudel	*abyssinica* Hochst.	Abyssinian oats.

Elaborating on this classification, Carleton enumerated, under common oats (*A. sativa*), the nine subspecies as given by Körnicke (*91, 92*) and Körnicke and Werner (*93*), and then listed the various named varieties, both of foreign and American origin, under each. The same process of separation was carried out for the other groups. However, a classification of this kind is of value only for the iden-

tification of varietal groups, as it is not adequate where a finer separation of varieties is desired.

Etheridge, in 1916 (*61*), presented a classification of American oat varieties, based upon their characteristics when grown in the environment of Ithaca, N. Y. This was the first real comprehensive work originating in the United States to appear on the classification of the varieties of an important cereal crop plant. He reviewed the literature on previous foreign classifications and discussed the morphological characters of the oat plant that were useful for classification. The principal cultivated varieties of oats, together with their basic wild species, were classified into 8 groups or elemental types, namely: *A. nuda*, *A. sterilis*, *A. abyssinica*, *A. strigosa*, *A. brevis*, *A. fatua*, *A. sativa*, and *A. sativa orientalis*. Keys and descriptions for 55 varieties were given under the 3 species or subspecies as follows: *A. sterilis*, *A. sativa*, and *A. sativa orientalis*.

Etheridge studied 731 collections of oats and established as the name of the variety the one most frequently used for a given type in his collection (*61*, *p. 96*). Some of the varieties were merely listed under C. I.[1] numbers instead of under names. Emphasis was placed for the most part on purely botanical characters. Nevertheless, in the separation of distinct varietal types and the indication of the characters that entitle them to be called botanical varieties, Etheridge's work was a decidedly valuable contribution to the knowledge of oat varietal classification.

Stanton, in 1916 (*150*), published general descriptions of a number of winter oat varieties included in experiments at Arlington Farm, Rosslyn, Va., and at the Maryland Agricultural Experiment Station, College Park, Md.

Kiesselbach and Ratcliff, in 1917 (*89*, *pp. 22–25*), discussed types of panicles and spikelets found in a few of the oat varieties grown in Nebraska.

Stephens, in 1917 (*176*, *pp. 27–31*), presented brief notes on the origin and description of four oat varieties under experiment at the Sherman Branch Experiment Station, Moro, Oreg.

Montgomery, in 1918 (*109*), recorded the results of a study of the oat varieties of New York, and showed that four varieties, having only minor distinguishing characteristics, represented approximately 80 percent of the oats grown at that time in New York.

Burnett, in 1918 (*17*), presented information on the origin and description of 10 varieties of oats common in Iowa at that time.

Parsons, in 1918 (*125*), published general descriptions, and, in most cases, brief notes on the origin of the seven principal varieties of oats included in varietal experiments at the Wyoming Agricultural Experiment Station, Laramie.

Since the publication of the oat classification of Etheridge (*61*), Zade, in 1918 (*213*), reviewed the classifications of oat species by Atterberg (*8*), Cosson (*41*), Thellung (*190*), Denaiffe and Sirodot (*46*), Böhmer (*13*, *14*), Körnicke (*91*, *92*), and others, and classified varieties in accordance with the system of Körnicke and Werner (*93*). Körnicke and Werner presented rather complete descriptions of the more distinct cultivated varieties of Germany and an elaborate outline showing the origin of the numerous German varieties of *A. sativa*.

Pridham, in 1918 (*127*), presented brief general descriptions of

[1] C. I. refers to accession number of the Cereal Crops Section, Field Crops Research Branch, United States Department of Agriculture.

10 leading oat varieties grown in New South Wales.

Stewart, in 1920 (*178, pp. 20–21, 28–29*), published a key to the 14 varieties of oats, grown commercially in Utah at that time, and included brief varietal descriptions of 7 of these varieties.

Warburton and Stanton, in 1920 (*206*), in the presentation of yield data on a large number of the cultivated varieties of oats of the northern and western parts of the United States roughly grouped the varieties, based on type of panicle, time of ripening, and color of kernel (grain). This compilation included results from varietal experiments at 50 agricultural experiment stations.

Stanton, in 1921 (*151*), published a history and description of the Fulghum oat.

Salmon and Parker, in 1921 (*137*), described the Kanota oat, a variety similar and morphologically identical with Fulghum.

Pridham, in 1921 (*129*), grouped 72 varieties of oats in accordance with a number of the most obvious botanical and agronomic characters then included in experiments conducted by the Department of Agriculture of New South Wales. Brief notes on origin, breeding, distribution, and varietal defects also were given.

Stoa, in 1922 (*170*), described 24 varieties of oats grown commercially in North Dakota. He divided his varieties into 3 groups — early, midseason, and late—and presented descriptions of certain so-called varieties that, under most conditions, cannot be differentiated from other or identical varieties.

Helm and Stadler, in 1922 (*72*), grouped the varieties of oats grown in Missouri on the basis of length of growing season as follows: (1) Winter oats, (2) early spring oats, (3) medium early spring oats, (4) late spring oats, and (5) side oats. They presented rather complete general descriptions with notes on adaptation of Kherson (Sixty-Day), Silvermine, Red Rustproof, Burt, and Fulghum.

Leith and Delwiche, in 1922 (*98*), presented histories and descriptions of the six leading pedigreed oat varieties developed and distributed by the Wisconsin Agricultural Experiment Station, Madison.

Archer, in 1922 (*6*), gave detailed descriptions of 25 oat varieties grown in Australia in a classification bulletin. The characters used for distinguishing the varieties within the species (*6, pp. 9–14*) are as follows: *A*, Botanical—(1) straw and first node, (2) foliage, (3) panicle, (4) spikelets, (5) outer glume, (6) husk, (7) basal hairs, (8) rachilla (rachilla segment), (9) grain in husk, and (10) grain without husk; *B*, Agricultural—(1) early growth, (2) color, (3) seasonal variations, and (4) stooling capacity. This is the first classification that has appeared in which a rather extensive use of agricultural, or agronomic, characters has been employed in connection with those of a more distinct botanical nature for the identification of varieties. The general descriptive matter on characters other than those purely botanical adds materially to the value of the bulletin for the practical oat grower of Australia.

Marquand, in 1922 (*107*), presented the most recent, extensive classification of the oat varieties in cultivation. In this work, which deals primarily with the varieties of oats cultivated in the British Isles, the groups of varieties are ranged under their respective wild or elemental species. His detailed descriptions and keys include 6 species, 7 subspecies, and 112 varieties and subvarieties. Marquand divided *A. sativa* into undescribed subspecies, *autumnalis* (winter

oats) and *verna* (spring oats). Subspecies *verna* has 5 groups, which are largely based on color of lemma, size and shape of panicle, and time of maturity. He considers *A. orientalis* as a distinct species, and divides the varieties with side panicles into 2 groups: (1) Ripe grain, black or dark brown; and (2) ripe grain, white or yellow.

In addition, fatuoid types of certain cultivated varieties are treated, and observations on the effect of soil, moisture, and fertilizer on the variability of certain characters is given. Marquand stated that such characters as marginal hairs on the lamina, or culm leaves, are genetic, and therefore can be used in classification, while such characters as height of plant, number of spikelets in the panicle, and number of tillers per plant are affected by environment, and therefore, are unreliable. He further stated that the percentage of spikelets with awns in the panicle of plants from unselected varieties is constant, but probably dependent on multiple factors. Marquand's descriptions of American varieties agree well with those of Etheridge (*61*).

Schafer, Gaines, and Barbee, in 1923 (*141*), classified the 31 commercial varieties of oats under experiment at the Washington Agricultural Experiment Station, Pullman, in accordance with outstanding taxonomic characters. Brief notes on origin and description of these varieties were also given with a brief key.

Florell, in 1923 (*63, pp. 30–31*), described the Red Rustproof and Fulghum varieties grown in central California.

Stanton, Stephens, and Gaines, in 1924 (*175*), described a new variety with high resistance to covered smut, under the name of Markton.

Hunter, in 1924 (*84*), discussed the botanical characters of the oat plant and their use for classification, and presented a classification and description of species and varieties. Only varieties belonging to *A. sativa*, *A. sativa orientalis*, *A. strigosa*, *A. fatua*, and *A. sterilis* were included in his classification. Some of the newer English varieties described have not proved to be homozygous in the United States.

Coffman, Parker, and Quisenberry, in 1925 (*37*), published a very complete literature review of the grain characters and their value for the classification of red oats, with special reference to the Burt variety, in connection with a report of an extended study and analysis of the marked variability of grain characters found in Burt.

Coffman and Stanton, in 1925 (*38*), made a similar analysis of the Kherson, or Sixty-Day, oats and considerable variation was shown to exist in the unselected variety.

Duggar, in 1925 (*55, pp. 3–21*), described several varieties of southern oats, including a discussion of taxonomic characters and cultural practices.

Burnett, Stanton, and Warburton, in 1925 (*19*), presented histories and descriptions of four improved oat varieties developed in cooperative experiments between the Iowa Agricultural Experiment Station and the United States Department of Agriculture.

Hughes and Robinson, in 1925 (*80, p. 337*), recorded estimates of acreages and production of the Albion (Iowa No. 103), Richland (Iowa No. 105), Iowar, and Iogren improved oat varieties grown extensively in Iowa in 1924.

Stanton, Griffee, and Etheridge, in 1926 (*170*), registered 42 of the varieties described by Etheridge as standard varietal types. Twenty-two other varieties and strains were registered as improved agronomic varieties on which considerable historical and descriptive matter is given.

Similar registered lists of improved varieties and strains were published as follows: Stanton, Love, and Down (*171*), seven in 1927; Stanton, Love, and Gaines (*172*), one in 1928; Stanton, Gaines, and Love (*169*), five in 1929; Stanton (*154*), two in 1931, three in 1934 (1935), one in 1935, three in 1938, five in 1939 (1940), six in 1940 (1941), three in 1941 (1942), two in 1942 (1943), one in 1943 (1944), and one in 1944 (1945). Many of these improved registered agricultural varieties do not represent distinct elemental, or botanical, varietal types, although they may differ physiologically or pathologically. It, therefore, is necessary to classify many of them as belonging morphologically to older and established elemental varietal types regardless of whether the older strains of these types are now of much economic importance.

Stanton and others, in 1927 (*159*), reported rather extensive notes on the origin, breeding, and description of numerous varieties and strains of fall-sown oats.

Zavitz, in 1927 (*215*), reported on experiments with varieties of oats grown in Ontario, Canada, including varieties eligible for registration, new crossbred varieties, and hull-less varieties. Results of various studies on weight per bushel, stooling, width of leaves, and awning in oats are also given.

Langelier, in 1927 (*97*), described Banner oats as one of the best varieties for the Province of Quebec, Canada.

Burnett, in 1928 (*18*), reported the history, selection, and performance of the Iogold variety.

Stanton and Coffman, in a series of Farmers' Bulletins (*160–164*), presented brief general descriptions of varieties recommended for growing on farms in all sections of the United States.

Dungan and Burlison, in 1929 (*58*), gave brief notes on the origin, description, and productivity of 54 oat varieties tested at the Illinois Agricultural Experiment Station, Urbana. At that time a large percentage of these varieties were of little or no economic importance in Illinois.

Stadler and Kirkpatrick, in 1930 (*149*), described Columbia, a new oat variety for Missouri.

Levine, Stakman, and Stanton, in 1930 (*100*), presented brief notes on the origin, description, distribution, and economic importance of 23 varieties of oats grown in uniform rust nurseries during 1923 to 1927, inclusive.

Vass and Hartman, in 1930 (*200*), published notes on origin and botanical description of 17 varieties of oats tested by the Wyoming Agricultural Experiment Station, Laramie.

Robertson and coworkers, in 1930 (*135*), described Colorado 37 and Brunker, developed in Colorado, and they discussed the groups and varieties of oats tested at the different branches of the Colorado Agricultural Experiment Station.

De Villiers and Sim, in 1930 (*51*), published a classification and detailed description of oat varieties grown in the Western Cape Province, Union of South Africa, in which keys were given for nine elemental botanical varietal types. Several improved agricultural varieties are named that are considered synonymous with the elemental types. No minute distinctions are made. For example, the Algerian group includes Algerian (Red Algerian in the United States), Sidonian, River Plate, Appler, Smyrna, Red Rustproof, Bancroft, and Texas (Texas Red in United States).

Malzev, in 1930 (*105*), published the results of an extensive investigation on the classification of the wild and cultivated species of oats belonging to the section *Euavena*, of which 184 botanical forms are de-

scribed. This work deals largely with phylogenetic and taxonomic relationships with only limited discussion of the classification of the derivatives of *A. sativa* and *A. byzantina*, which embrace all the cultivated oats grown in America. As a consequence, it is of no special value to those who are interested primarily in the identification and classification of agricultural varieties.

Bussell, in 1931 (*21*), presented general descriptions of four improved varieties of oats grown commercially in New York.

Derick, in 1931 (*47*), published standard descriptions of eight registered oat varieties grown commercially in Canada.

Derick, in 1931–32 (*48*), presented brief notes on the origin and description of 14 varieties of oats grown in Canada.

Norton and Powers, in 1932 (*120*), presented brief statements on the origin, and gave general descriptions of 14 oat varieties grown commercially in Montana.

Stanton, in 1933 (*155*), described Navarro, a distinct botanical oat variety with high resistance to smut, from Texas. This variety may have been introduced from Mexico.

Hadfield and Calder, in 1934 (*67*), described 11 distinct botanical varieties of oats grown in New Zealand. Several commercial varieties synonymous with some of these 11 types are mentioned.

Barbee, in 1935 (*9*), presented tabulated descriptions of certain characters of 57 varieties and strains of oats grown by the Washington Agricultural Experiment Station, Pullman. The characters, considered to be of value for purposes of classification, are time of heading and ripening, height of plant, panicle type, and grain color.

Summerby, in 1936 (*183, pp. 7–10*), published brief descriptive notes on three improved varieties of oats for eastern Canada.

Robertson and others, in 1936 (*136*), gave notes on the history and description of four registered oat varieties adapted to Colorado.

Stanton, in 1936 (*156*), recorded the origin, breeding, and distribution of the improved oat varieties of the world, many of which are classified as elemental varietal types in this publication.

Stoa, Smith, and Swallers, in 1936 (*180*), gave a history and description of each of the 18 oat varieties that have been tested at experiment stations in North Dakota. Similar information on some of these varieties is given in an earlier publication by Stoa (*179*).

Taborda de Morais, in 1936 (*187*) and in 1937 (*188*), published a classification with descriptions of the species and varieties of oats collected at l'Universite de Coimbra, Portugal.

Derick, in 1937 (*50*), published standard descriptions of registered oat varieties for Canada. In this second publication of its kind, the general descriptions have been revised on the basis of character variability due to environment. It was found that the range of variation in some characters, owing to different growth conditions, fluctuated too much to allow them to be useful for descriptive purposes.

Derick, in 1937 (*49*), published an identification key to 35 oat varieties, based on some of the most obvious plant and grain characters. Many of these varieties are grown extensively in Canada.

Taborda de Morais, in 1938–39 (*189*), published results of a much more comprehensive study, made at the same institution, on the classification of the oat species than that in 1937. The botanical forms of *Euavena* are grouped mainly in accordance with the system advanced by Malzev (*105*). Hence, an extended review of these publications by Taborda de Morais is not ger-

mane to the major purpose of this bulletin, since they include primarily a study of the species and not of the more important cultivated varieties.

Welsh, in 1939 (*207*), described a new stem-rust-resistant variety, under the name of Vanguard, suitable for growing in Canada.

Kugler and Foucault, in 1939 (*95*), published a key to and descriptions of varieties of oats then grown in Argentina, namely Klein Mar, Klein Capa, Klein Victoria, and La Prevision 13.

Kiesselbach, Webster, and Quisenberry, in 1940 (*90*), presented brief information on the breeding and description of nine varieties of some agricultural importance in Nebraska.

Stanton, in 1940 (*157*), described the grain characters that were most useful in differentiating oat varieties grown in the South.

The Canterbury Agricultural College, in 1941 (*23*), presented notes on the origin and description of 20 named varieties of oats grown in New Zealand.

Dungan, Bonnett, and Burlison, in 1942 (*57*), presented tabulated descriptions of certain botanical and agronomic characters of 71 varieties of oats tested in Illinois.

Stoa and Swallers, in 1942 (*181*), gave brief descriptions of the oat varieties commonly grown in North Dakota, as well as certain improved, disease-resistant ones.

Schlehuber, Sturm, and Bamberg, in 1942 (*143*), gave brief notes on the origin and description of 13 varieties of oats grown on irrigated and dry land in Montana.

Harrington and Shebeski, in 1942 (*70*), presented brief information on the origin and general description of the recommended and promising new varieties of oats for growing in the Province of Saskatchewan, Canada.

Murphy, Stanton, and Coffman, in 1942 (*113*), gave the origin and some descriptive notes on a relatively large number of newly developed and recently named varieties of disease-resistant oats. Many of these are similar to the parental or older standard varieties.

Stoa and Swallers, in 1943 (*182*), gave the origin and briefly described new disease-resistant oat varieties for North Dakota.

Stanton and Coffman, in 1943 (*166*), gave the origin and general descriptions of 7 highly productive, new disease-resistant varieties for the Corn Belt. They also (*165*) presented the origin and general descriptions of 17 new disease-resistant and hardy varieties of winter oats for the South.

Beeson, in 1944 (*12, pp. 2–3*), presented brief descriptive notes on the older and newer varieties of oats then being grown in Indiana.

Welsh, in 1944 (*208*), described Ajax and Exeter, two new oat varieties with resistance to stem rust for Canada.

Kugler, Foucault, Cialzeta, and Lemos, in 1945 (*96*), published a revision of the 1939 classification by Kugler and Foucault, and described five botanical and agricultural varieties of oats grown in Argentina—La Prevision 13, Buch 152, Klein Capa, Klein Mar, and Klein Victoria. The first two were classified as belonging to *A. byzantina* and the last three as belonging to *A. sativa*.

Quisenberry, Webster, and Kiesselbach, in 1945 (*130*), presented information on the origin and description of 18 varieties of oats grown in Nebraska.

Hancock and Long, in 1946 (*69*), gave the origin and described the newer varieties of oats grown in Tennessee.

Musil, in 1946 (*115*), published results of a study on the differentiation of the species of *Avena* based on seed characters with spe-

cial reference to seed certification. She described the characters useful for classification of cultivated oats, fatuoids, and certain wild species of economic interest.

Heyne, Johnston, Hansing, and Clapp, in 1947 (*75*), reported on Osage and Neosho, two new rust- and smut-resistant varieties of oats for Kansas.

Atkins and McFadden, in 1947 (*7*), presented information on the origin and description of the oat varieties grown in Texas, including the more recently distributed disease-resistant varieties.

PRESENT INVESTIGATIONS

Preliminary investigations looking toward the present classification of oat varieties were begun in 1913 by the late C. W. Warburton.[5] From 1913 to 1917 the more important commercial varieties of oats then grown in the United States were collected and identified. These varieties were obtained mostly from seedsmen and agricultural experiment stations. Much descriptive matter was recorded by Dr. Warburton and the writer, and a fairly complete collection of the different varieties and strains was assembled for study and reference.

The advent of the participation of the United States in World War I in 1917 and the assignment of C. W. Warburton to special agricultural defense work seriously interrupted the investigational work with oats.

In 1920, however, owing to the great economic importance of oats in the United States, the work of identification and classification of oat varieties was resumed by the writer. In addition to the collection, growing, and study of varieties from various sources in the United States, numerous foreign varieties and strains were grown and are described herein. Those that were promising as agronomic varieties or for plant breeding, as well as those that were morphologically distinct, have been included in the present investigations.

[5] Agronomist in charge of oat investigations, of the then Office of Cereal Investigations, United States Department of Agriculture.

EXTENT AND NATURE OF PLANT MATERIAL

The first collection of oat varieties for the inauguration of classification studies was made in the spring of 1913. Altogether, more than 900 samples were collected, to which definite classification accession numbers were assigned. The number of distinct varieties and strains was reduced each year until about 200 remained in 1917, when identification studies were discontinued temporarily. With the resumption of these studies, a new collection of nearly 700 varieties and strains was made in the winter of 1919 and 1920. This, with the approximately 200 varieties and strains remaining from the collection made in 1913, made a total of about 900 available for classification studies. Furthermore, many introduced and newly developed varieties were added from year to year.

The first phase was to separate the different types contained in the various stocks. Fully two-thirds of the commercial stocks represented admixtures of varietal types. In other stocks, which apparently were of hybrid origin, there were still evidences of genetic segregation. These, as a rule, were discarded unless a homozygous type was obtained after a few years' selection.

In these studies it has been necessary to base statements on the general reaction of varieties to different environments rather than to a definite environment. The devel-

opment of certain characters, such as panicle size, attitude of panicle branches, number of florets per spikelet, and lemma color, vary under different environments. Color of lemma (grain) is especially influenced by environment.

IDENTIFICATION NURSERIES

Oat classification nurseries have been maintained for a number of years at Ames, Iowa, and Aberdeen, Idaho, in cooperation with the respective State agricultural experiment stations. In 1922, 1923, and 1926, classification nurseries were grown at the Dickinson Substation, Dickinson, N. Dak., in cooperation with the North Dakota Agricultural Experiment Station, in order to determine the reaction of varieties to a dry, semiarid climate. A nursery also was grown at Edmonton, Alberta, Canada, in 1929, in cooperation with the College of Agriculture at the University of Alberta. Unfortunately the varieties were not studied for classification purposes. In 1923, the more distinct elemental types were grown also at Arlington Farm, Rosslyn, Va., to determine their relative early growth habit from fall seeding.

The varieties in the classification nurseries were grown in 5-foot rows 1 foot apart. The first year a strain was grown, a mass lot of the seed was used and sown rather heavily to determine the number of types it contained. Thereafter nearly all the different strains and varieties were grown from panicle selections, the seed being dropped at 3-inch intervals in the rows. The use of pure lines was necessary in order to avoid confusion in the descriptions. After the more distinct elemental types had been established, the sowings of each variety were enlarged to plots of four 5-foot rows. This afforded a much better comparison of the varieties in the field and furnished larger quantities of seed for teaching purposes.

These nurseries were grown under as nearly typical field conditions as possible. The oat plant develops rather fully in favorable seasons at Ames, Iowa, where climatic and soil conditions, although not altogether ideal, are representative of the principal oat-producing regions of the United States. At Aberdeen, Idaho, conditions are particularly favorable for the development of the oat plant when grown under irrigation. There, the altitude is nearly 4,400 feet and the atmosphere is warm and dry during the day and cool at night. Summer rains are infrequent. Under such conditions the oat plant probably attains nearly maximum development with almost complete freedom from discoloration due to weathering or plant diseases.

PREPARATION OF DESCRIPTIONS, HISTORIES, AND DISTRIBUTION

All of the distinct varieties here considered are described in sections that follow. In arriving at these descriptions only those characters of some taxonomic value have been considered. The description of each variety is as complete as is practicable. The chief characters that distinguish a variety from closely related sorts also are listed. In addition, pathological reactions or certain physiologic characters of certain varieties that might be useful in plant breeding are listed.

PREPARATION OF VARIETAL HISTORIES

The origin of a variety often furnishes clues as to its probable characteristics. The history of a variety also aids in clarifying its synonymy and nomenclature. The present classification includes such historic

information as is available regarding the varieties of oats grown in the United States. The history of all but a few varieties is known.

Varieties of oats introduced from foreign countries by the United States Department of Agriculture have been recorded since 1907. State agricultural experiment station bulletins, agricultural periodicals, scientific journals, and seed catalogs have furnished considerable information on the origin of many of the older varieties.

On the whole, the nomenclature of oat varieties has been, and still is, unsatisfactory. Many varietal names are very long and often largely descriptive. Other names are freakish or misleading. The use of numbers by various agencies has not contributed to a satisfactory varietal nomenclature, as numbers are more easily confused than names. It is hoped that in the future all new varieties will be given names when they are distributed. The practice of designating improved varieties by names that suggest the name of the State or institution in or at which they were developed has some objection. This is especially true if a variety is of merit in adjoining States where State pride might be a factor in deterring its wider recommendation, thus retarding or curtailing its utilization. The recent practice of naming improved varieties for counties common to several adjoining States is overcoming some of these objections.

DETERMINATION OF THE DISTRIBUTION OF OATS

The distribution and acreage of different varieties of oats furnish excellent evidence on the adaptation of varieties. Many new varieties that have appeared from time to time soon passed into oblivion. The better varieties, however, often maintained their importance for many years. Largely because of the great similarity of many oat varieties, inferior strains are likely to continue in cultivation for some time. Many farmers persist in growing mixed or nondescript varieties because their oat crop is more or less incidental and does not contribute materially to their annual cash income. The opinion still prevails in many sections that any oat variety will be satisfactory provided soil and climate are favorable. Nevertheless, the development of disease-resistant varieties with superior yield and quality in recent years has made farmers much more varietal conscious.

VARIETAL SURVEYS

A varietal survey was conducted in 1919 in cooperation with the then Bureau of Crop Estimates, United States Department of Agriculture, to determine the varieties of oats grown commercially in the United States and the extent of their distribution. About 25,000 returns were received, including 1 or more from nearly all counties in which oats are grown. About 18,000 of these contained usable information. Descriptive matter furnished by the reporter in the space provided in the schedule often aided materially in checking the authenticity of the varieties reported.

Some varieties were reported merely as "black" or "white" oats. These were checked by growing plants from seed obtained from the grower. Approximately 200 samples of seed were received from the survey reporters, but no distinct, new varietal types were obtained. All proved to be identical with known varieties.

The results of the 1919 survey are now out of date and therefore are of comparative value only. However, the acreage of the more important varieties grown at that time is given in the varietal history.

THE OAT PLANT, ITS CHARACTERS, AND THEIR VALUE FOR CLASSIFICATION

The oat plant may be characterized as a midtall, annual grass, with hollow, jointed stems, flat blades, and a terminal panicle. The panicle branches alternate on the rachis and are arranged in whorls. The spikelets separate from their pedicels and the florets from their rachilla segments. The glumes (empty glumes) often persist after the lemma and palea have fallen. The lemma is bifid or entire with its midrib frequently extending into an awn, which may be nontwisted (straight) to twisted and geniculate. The caryopsis, or kernel, is furrowed, and the embryo is small. The starch grains of the oat kernel are compound.

The varieties of oats vary in their habit, form, and structure. The main parts are the roots, culms, leaves, panicle, and fruit. There are two kinds of roots—seminal and coronal. The culm, or stem, is a hollow, jointed body, cylindrical in form and usually having four or five nodes and internodes. The upper internode is called the peduncle. The leaf consists of the blade, sheath, and ligule. The panicle is composed of the rachis, rachis branches, and spikelets.

The spikelets are composed of the glumes and one or more florets, infrequently exceeding three, except in the naked varieties. The floret includes the rachilla segments (rachilla), the lemma or flowering glume, palea, the sexual organs, or later when developed the caryopsis, or kernel, proper. The organs of reproduction consist primarily of the three stamens, their filaments and anthers, the single ovary within its style, and bifid stigma. The inflorescence of oats as originally developed by Boettcher, and redrawn by Mrs. Regina O. Hughes, is reproduced in figure 2.

A strictly botanical classification of the varieties must necessarily be based upon the diversity of the aforementioned characters. Some of those characters, such as the roots, which vary but little and cannot be conveniently examined, are of little or no value for identification purposes. In the oat plant as a whole, relatively few characters show marked variation. There are many minute characters that are

FIGURE 2.—The inflorescence of common oats: (*1*) Panicle of *Avena sativa;* (2) distal or top part of panicle, bearing four spikelets; (*3*) lateral view of spikelet (one-flowered) in anthesis, showing separated lemma and palea with one branch of plumose stigma and three stamens (*7*) protruding; (*4*) lateral view of lemma, showing dorsal attachment of awn; (*5*) ventral view of palea; (*6*) lodicules; (*7*) stamens; (*8* to *13*) lateral views of a floret before, during, and after anthesis; (*14*) diagrammatic longitudinal dorsal-ventral section of floret, showing lemma, (*e*) palea, androecium, and gynoecium; (*15*) diagrammatic cross section of spikelets of three-flowered spikelet before anthesis—(*a*) lower, or outer, glume, (*b*) upper, or inner, glume, (*c*) lemma, or flowering, glume, (*d*) palea, (*e*) anthers, (*f*) stigma, (*g*) lemma of secondary floret with enclosed palea, stamens, and stigma, (*h*) rudimentary tertiary floret; (*16* to *18*) androecium before, during, and after anthesis; (*19*) apical portion of stigma, greatly enlarged, showing adhering pollen grains; (*20*) diagrammatic cross section of anther; (*21*) pollen grains, enormously enlarged; (*22*) floret, ventral and dorsal view of caryopses (× ¼); (*23*) mature primary floret (kernel), ventral view, showing inrolled edges of lemma, dorsal view of central part of palea, and attached rachilla segment which bore the secondary floret; (*24*) caryopsis, dorsal view, showing embryo, scutellum, and pubescence on seedcoat; (*25*) caryopsis, ventral view; (*26*) caryopsis, lateral longitudinal (sagittal) view, showing endosperm and embryo; (27) caryopsis, cross section. (Original drawing by Boettcher, redrawn by Mrs. Regina O. Hughes.)

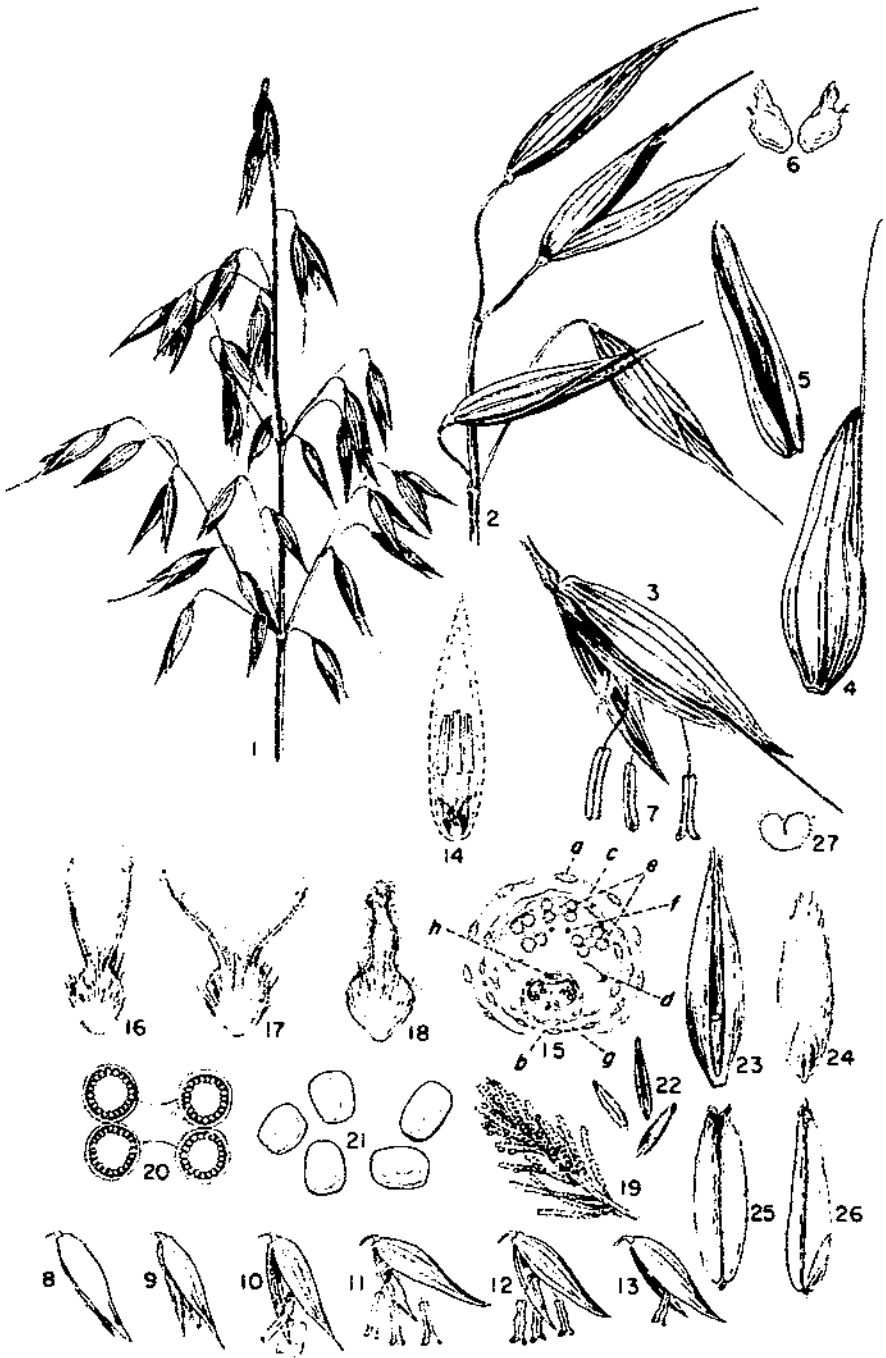

FIGURE 2.—See legend on page 14.

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more or less constant but not altogether satisfactory for use in identification because they are inconspicuous or are difficult to describe.

A few qualitative or physiologic characters of the oat plants are of interest primarily from the agricultural or agronomic viewpoint rather than for their use in morphological descriptions. In the general descriptions, following the botanical descriptions of the varieties, brief statements of such physiological and pathological characters that may aid in identification are included. It is well known that two strains of oats may be similar or identical morphologically, but may differ widely in their physiologic and pathologic manifestations, particularly with regard to environmental response and disease reaction.

MORPHOLOGICAL CHARACTERS

The morphological characters of the oat plant that have been found to be of some taxonomic value in these studies are considered in detail in this section. In addition, certain characters of little taxonomic value are briefly discussed to make the study as complete as possible.

It is apparent from most of the earlier foreign classifications that investigators had few or no forms of winter oats available for study. Even at the present time the actual number of varieties of economic importance that show the spreading, or prostrate, habit of growth with some degree of winter hardiness is comparatively small. For this reason it is possible at the outset to separate the few more or less distinct winter forms from the much larger number and more important group of spring oats—nearly all of which have an erect habit of growth.

As a rule, varieties that show a distinct prostrate or winter habit cannot be grown very successfully from spring seeding because they often mature too late. Among varieties of this type are Boswell, Hairy Culberson, and Winter Turf, which, especially when sown rather late in the spring in the North, sometimes failed to head. Other prostrate to semiprostrate varieties, such as Black Algerian and Coastblack, are extremely late in maturity, but these lack sufficient winter hardiness to be grown in much of the winter oat region.

The Red Rustproof and Fulghum varieties exhibit the prostrate to semiprostrate and semiprostrate to erect habit, respectively. Varieties of these types may be grown successfully in the South from either spring or fall sowing, although different strains of these varieties, particularly of the Fulghum, show marked variation in habit of growth. In the winter oat experiments of the Cereal Crops Section at Arlington Farm, Rosslyn, Va., a strain of Fulghum, such as Pentagon from which Forkedeer and Fulwin were later isolated, showed a more prostrate habit of early growth, with much more winter hardiness, than did the typical spring or intermediate strains of Fulghum.

In the oat classification major separations are made on type of panicle, color of matured lemma, time of maturity, habit of early growth, and plant height. In the keys to the groups of cultivated oats, these major characters are considered in a more or less definite sequence. Thereafter any secondary character is used that serves to distinguish a variety. The principle has been followed in a general way, especially in the keys, of progressing from characters most conspicuous and most easily observed to those least con-

spicuous and least easily observed and in some cases less definite.

JUVENILE PLANT GROWTH

Three forms of juvenile, or early, plant growth habit during the first period of development have been recognized in these studies: (1) Prostrate, (2) semiprostrate, and (3) erect (fig. 3.)

FIGURE 3.—Juvenile plant growth habit in oats: *A*, erect, *B*, semiprostrate, and *C*, prostrate. (¾ ×.)

These are essentially the same as the three forms recognized by Etheridge (*61, pp. 121-122*). The plants with prostrate (turflike) habit in early growth assume an erect form from a somewhat curved or decumbent base later in the life of the plant. Plants of the semiprostrate habit of early growth are less prostrate than those with the most pronounced prostrate habit. From the time of culm formation to that of heading, the tillers slant at an angle of 45° or more. Plants with erect (not turflike) habit of early growth assume that form from emergence, and the tillers develop from a more or less upright base.

Distinctly spring varieties can be grown successfully in mild winters from fall sowing in the South, but they always show the erect habit of growth.

TIME OF MATURITY

Etheridge (*61, p. 112*), Marquand (*107, p. 5*), and Archer (*6, p. 14*) used time of maturity as a character in classifying oats. Etheridge doubted the value of time of ripening beyond certain limits of a particular environment. Marquand failed to discuss the value of time of maturity under the climate of Wales, although he used this character in his descriptions. In Australia, Archer pointed out that time of maturity was very useful in grouping varieties under the long-growing season of that country.

Time of maturity was a useful character under the varying climatic conditions of the present investigations. It was observed that when sown at the normal or optimum date varieties that were distinctly early under Corn Belt conditions also were early under the semiarid climate of the northern Great Plains and under irrigation at high altitudes in southern Idaho. The midseason varieties likewise maintained their respective posi-

tions in different regions. The main difficulty experienced was in grouping the varieties that ripened in intermediate periods. In this bulletin the terms (1) "very early," (2) "early," (3) "midseason," (4) "late," and (5) "very late" or "extremely late" are used. Most varieties fall within the three middle classes.

Time of seeding greatly influences the time of maturity. Late seeding is not favorable to the differentiating of varieties on the basis of time of ripening. Early, midseason, and late-spring varieties when sown in early May at Aberdeen, Idaho, usually fail to show marked variation in time of ripening, whereas when sown 3 weeks earlier, which apparently represents the optimum date of seeding, satisfactory differentiation for maturity was shown.

TILLERING

The tillering ability or stooling capacity, as designated by Archer (*6*), is employed chiefly in separating winter from spring varieties of oats. In the present investigation, the stooling capacity has been expressed in terms of many and few. Archer (*6, p. 14*) recognized an intermediate or medium group, which he discusses as follows:

> No numerical value can be set to these terms, as the exact number of stems per plant will depend on soil, temperature, rainfall, and method of cultivation, and a number which would represent abundant tillering in poor land could only be considered as medium to sparse in a rich district. However, a variety which tillers well in any one district may usually be relied on to tiller heavily wherever it is grown, whereas a poor stooler will hardly be likely to produce an abundance of stems in any district.

The writer corroborated these observations in the present investigations, but some difficulty was found in trying to recognize an intermediate group. The relatively higher number of tillers usually produced by winter varieties, such as Hairy Culberson, Winter Turf, Tech, Lee, and Letoria, are as a rule easily discernible from the relatively few tillers produced by any of the spring varieties. Among the large group of spring varieties, and especially among the more important economic varieties with a few exceptions, little differentiation can be made in the number of tillers normally produced. Therefore, the tillering capacity of oat varieties is best differentiated on the basis of two classes—(1) few and (2) many—primarily for the separation of winter from spring oats. No reference is made to this character in describing varieties having relatively few tillers, which in most cases are typical spring oats.

HEIGHT OF PLANT

Plant height usually is an important factor in oat production, as a variety must have sufficient height to permit the use of modern harvesting machinery. On the other hand, varieties may be too tall for grain production because of the danger from lodging, but they may be desirable for hay or straw production.

In these studies, height of plant has been taken as the distance from the crown of the plant at the ground to the tip of the uppermost spikelet of the panicle. The character of plant height has been used primarily in the present classification to distinguish between varieties otherwise closely related, although this character varies with environment and time of seeding. Three general ranges of height have been used: (1) short (60 to 90 cm.), (2) midtall (90 to 120 cm.), and (3) tall (120 to 150 cm.). Where differences in height are used in keys to

differentiate between otherwise similar sorts, the average range in height of the variety also is given in centimeters. In the botanical descriptions of the varieties it has seemed desirable to give the height character in actual measurement in centimeters.

Plant height, like many other quantitative characters, as already referred to, is extremely responsive to soil and climatic conditions and is highly variable. Nevertheless, this does not prevent the differentiation as to comparative heights under usual conditions. If normally tall varieties are midtall under a certain environment, midtall varieties likewise are likely to be short, and short varieties extremely short. However, where comparative varietal heights cannot be ascertained, or where only one variety is available, plant height is of little use for identification, unless the observer, as in this study, has seen the variety growing under a similar environment. Etheridge (*61, p. 120*) used this character for descriptive purposes only, indicating that it could not be considered always as a reliable means of identification.

STEM CHARACTERS
(Including Peduncle)

SIZE

(Diameter)

The culm (stem) and the peduncle (that part of the stem from the upper stem node to the lower or first rachis node) of different varieties of oats vary in size (diameter) or relative coarseness. Three sizes of stem and peduncle (fig. 4) have been recognized in the present investigations: (1) Small (fine);

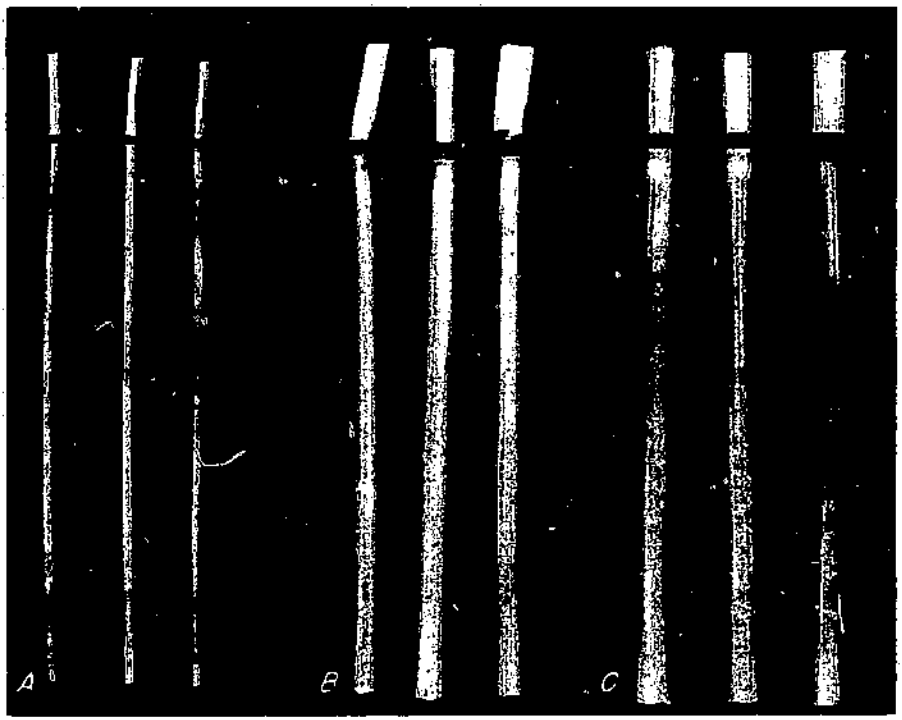


FIGURE 4.—Culm (stem) size in oats: *A*, Small, *B*, midsized, and *C*, large. (× ½.)

(2) midsized; and (3) large (coarse). The peduncle usually is straight, although sometimes slightly bent or curved. These characters, like plant height, are greatly influenced by environment and, therefore, variable. However, the same principle applies as in many other varietal characters, in that small varieties with small culms and peduncles, such as those of the Kherson type, are usually small, and varieties with large culms and peduncles, such as those of the Storm King and Victor types, are invariably large, regardless of habitat. Between the varieties with small and large culms and peduncles there is a very large group with midsized stems. Etheridge (*61, p. 124*) believed that these characters were of little value for classification purposes, but the writer has found that the varieties of oats usually can be grouped fairly satisfactorily into the three classes just mentioned.

COLOR

(Matured Culm, Straw)

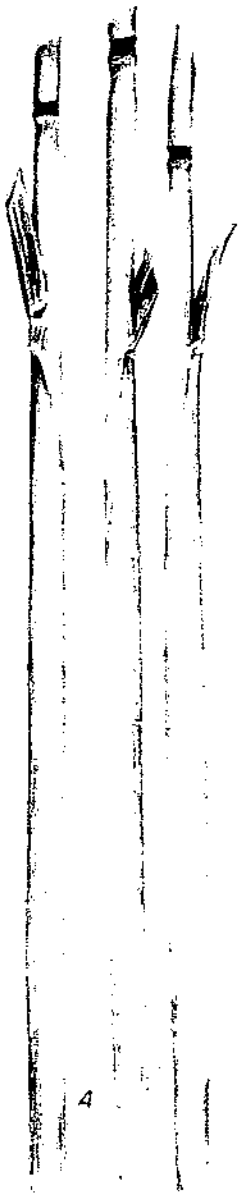
Color of the matured culm (stem), or straw, in oats is not an important character for the identification of varieties and is useful for general description only. This character is of major importance in separating the varieties of red oats from those of common oats. With few exceptions, the common oats are more yellow (pl. 1, *A*) and the red oats show a reddish-yellow color in the matured culms (pl. 1, *B*). These differences have been recorded by many investigators.

STRENGTH OF STRAW

Strength of straw (culm) has been described as stiff (strong) or weak and is of value for general description only. There are varieties with straw that might be described as midstrong, but this extra descriptive term would only further add to the indefiniteness of what constitutes a weak or strong straw. Size of culms is frequently associated with strength of straw, as varieties with small stems sometimes are weak-strawed and lodge quickly. This correlation, however, is not always true in varieties with midsized and large culms. It has been observed that in the large group with midsized culms, including many of the most important economic varieties, the straw is stronger and lodges less quickly than in varieties with unusually large culms, such as Victor and Storm King.

HAIRINESS OF INTERNODES

Etheridge (*61, p. 121*) stated that the pubescence, or hairiness, which occurs near the culm nodes in many varieties is not useful for classification purposes. In the present investigation, however, this character has been found of value in differentiating between varieties otherwise similar or identical. The internodes of many varieties frequently may show a slight hairiness near or at the nodes, but in such varieties the character is neither constant nor sufficiently developed for the purpose of classification. On the other hand, there are a few varieties in which the character is apparently constant and sufficiently developed, especially at the upper culm node, to serve as a fairly reliable means of identification. In the general descriptions of varieties, and where used in keys, the internodes (fig. 5) are described as hairy (pubescent) and glabrous (nonhairy).



The two stem colors found in oats: *A*, Yellow; *B*, red. (Natural size.)

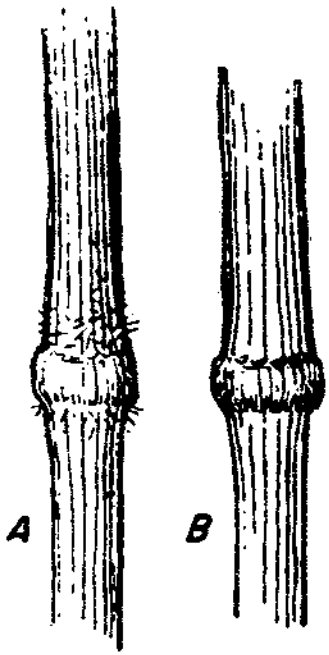


FIGURE 5.—Hairiness of culm internodes of oats: *A*, Pubescent (hairy) and *B*, glabrous (nonhairy). (After Etheridge.)

LEAF CHARACTERS

In this study the principal parts of the leaf considered are the blade, sheath, and ligule.

BLADE

The blade may be described as narrow, midwide, and wide. This character is of minor importance for classification, as the range between narrow and wide leaves is not sufficiently great in most varieties to afford a reliable means of identification. Most varieties produce leaves that are best described as midwide, although there are a few varieties with distinctly narrow leaves, such as Winter Turf, and others with decidely wide leaves, such as Sparrowbill, Storm King, and similar varieties of the late side oats group.

MARGINS

The margins have been described as either ciliate (hairy) or glabrous (nonhairy). Ciliation appears to be a rather constant character in most varieties. Owing to their inconspicuousness, however, these hairs are of only minor value for the identification of varieties. In fact, the character is comparable with the hairiness of the sheaths, which cannot be used to great advantage for the identification of varieties. Most varieties show some marginal ciliation; the number of hairs varying from many to only a few (fig. 6).

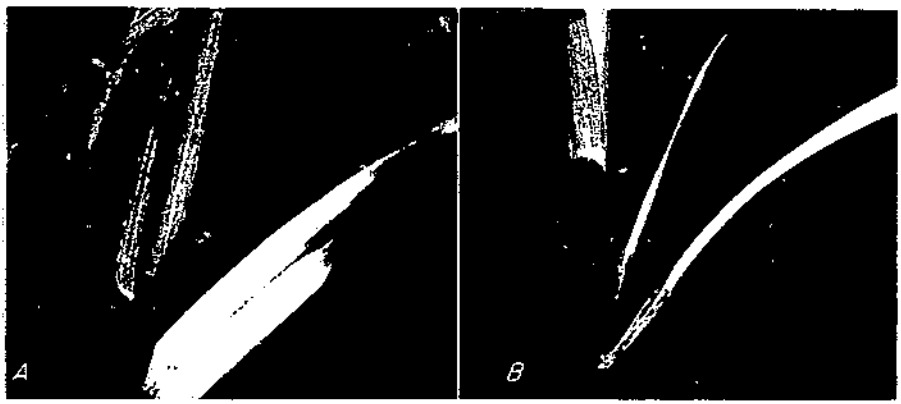


FIGURE 6.—Hairiness of sheaths and leaf margins of oats: *A*, Hairy sheaths and ciliate leaf margins; *B*, glabrous (nonhairy) sheaths and leaf margins—only a few hairs are evident. (× ⅔.)

SHEATHS

The sheath, or lower part of the leaf that encloses the stem, affords no satisfactory characters for use in classification. Etheridge (*61*, *p. 130*) recognized two classes with respect to length of sheath and mentioned that this difference was correlated with the presence or absence of ligules. In the nonligule-less varieties, the leaf blade lies close to the stem for a distance above the node and serves to overcome the weakness necessarily induced by the absence of the ligule. In varieties with ligules, there is a definite separation between the sheath and blade, the blade not touching the culm above the point where the ligule clasps the stem. As this difference is closely associated with presence and absence of the ligule, it is discussed more fully under ligules.

The presence or absence of hairs on the sheaths is stated to be genetic, and, as a consequence, considered to be of value for classification by Marquand (*107*, *p. 4*). In this study this character has not been found of sufficient constancy to use for the identification of varieties. The terms "glabrous" (nonhairy) and "hairy" (pubescent) are used for descriptive purposes only (fig. 5). Furthermore, accurate and definite observations on this character are difficult to make. After some study it has been found that the only sheath character of definite taxonomic value is the presence or absence of the ligule.

LIGULES

At the junction of the leaf blade and sheath, there is a scarious cartilaginous, membranous appendage, or fringe, with a toothed edge, called the ligule, that serves to hold the leaf and leaf sheath tightly to the culm. Nearly all varieties of oats have ligules but no auricles or clawlike structures curved around the culm, such as are found in wheat and barley. Etheridge (*61*) apparently confused auricles with ligules when he stated that auricles are present in most varieties. Robbins (*134*, *p. 123*) stated that auricles (not ligules) are always absent, which is in full agreement with the observations made in this study. The absence of auricles is the character by which oats is commonly distinguished from wheat and barley in the seedling stage. Carrier (*27*) reported on the value of the auricle for the identification of the different small grains in the seedling stage. His classification for oats, wheat, rye, and barley is reproduced in figure 7.

The absence of the ligule in a few varieties belonging to *Avena sativa* subspecies *orientalis* is of much taxonomic value.

Etheridge (*61*, *pp. 119–120*) described the general morphology of the absence of the ligule in these varieties as follows:

> In all these varieties the leaf is approximately continuous in structure with the sheath and its characteristic form may easily be recognized. Unlike the ordinary leaf, it does not bend away from the stem at its junction with the sheath, but extends upward, and for a part of its length it is nearly parallel with the stem . . . .

In the present classification of the varieties of the subspecies *A. orientalis*, the presence or absence of ligules has been used as a major character (fig. 8). As the ligule is definitely present or absent, this character is most valuable for the identification of certain varieties with side panicles. There is no marked differences in the length, size, and serrations in the ligule that can be used for the purpose of classification.

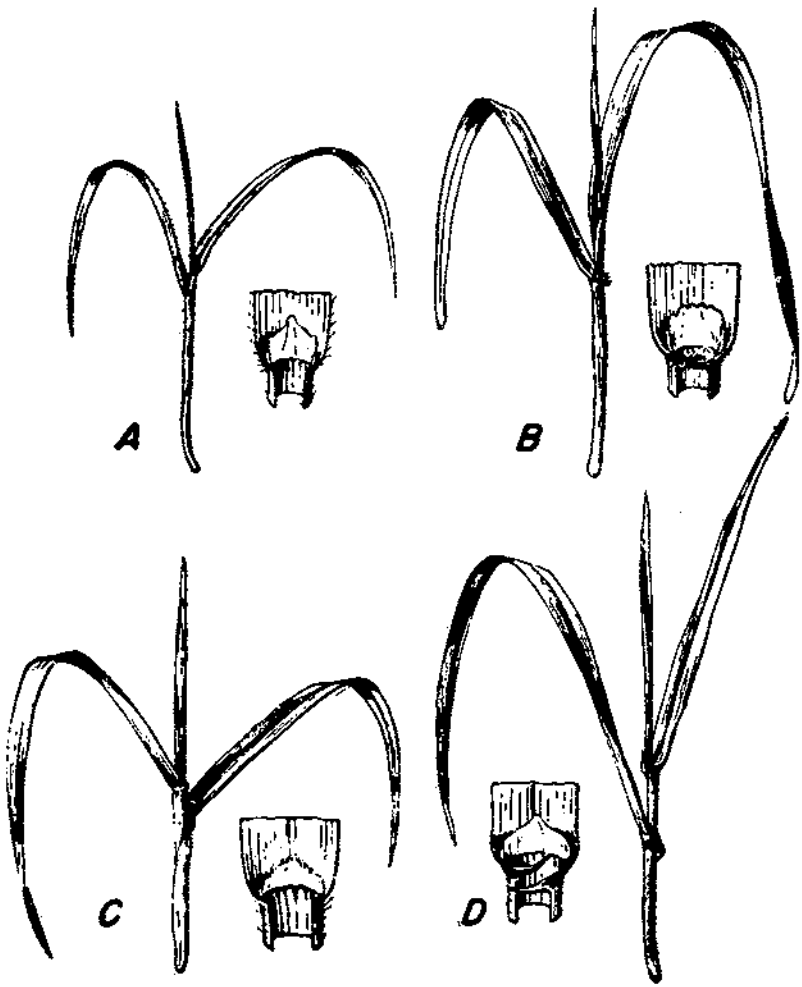


FIGURE 7.—Auricles and ligules of small-grain seedling plants: Absence of auricles in oats (*A*); and the presence and relative size of auricles in wheat (*B*), rye (*C*), and barley (*D*). The relative length, shape (form), and serrations of the ligules are also shown. (After Carrier.)

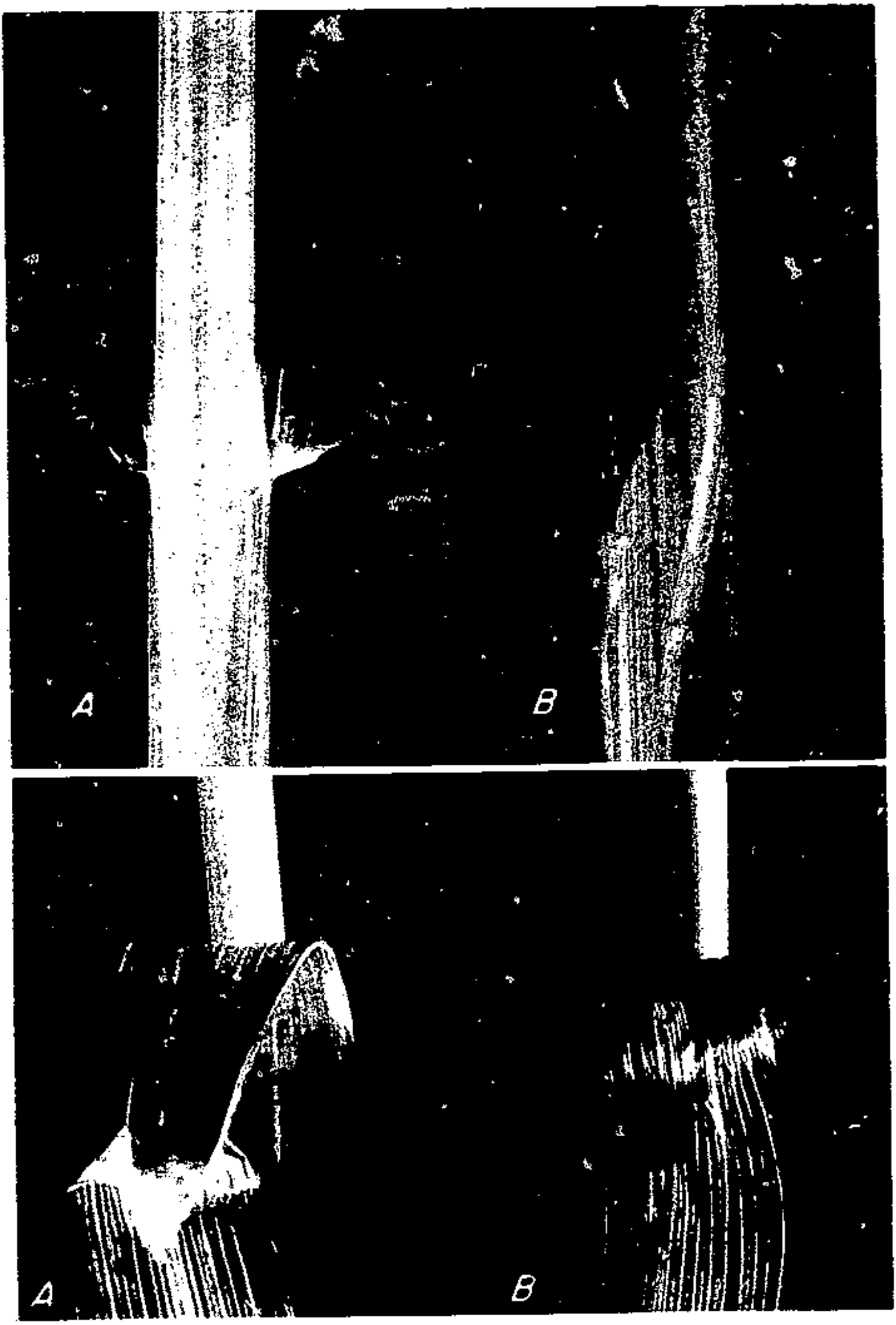


FIGURE 8.—A, Liguled oat; B, liguleless oat. Upper view shows relative positions of leaf blades of (A) liguled and (B) liguleless oats. (In the absence of ligule the leaf blade clasps the culm.) (× 3.)

PANICLE CHARACTERS

POSITION OF PANICLES

The position, or attitude, of the panicles on the culms has been used to describe varieties. Considerable confusion exists as to distinction between erect and drooping panicles. In the present study, the terms "erect" and "drooping" have been used, more particularly in describing those varieties that have shown some consistency with regard to this character. Certain varieties usually have erect panicles under nearly all conditions, whereas other varieties with unilateral panicles tend to be somewhat drooping.

The general form of the panicle, or inflorescence, is similar in all species of the tribe Avenae, but within the cultivated varieties of oats there are two distinct forms of panicle that are generally recognized by all authorities on oat varieties. These two forms (fig. 9) are (1) equilateral (treelike, spreading, or branching) and (2) unilateral (side, banner, or horsemane). Etheridge (*61, pp. 116–117*) was the first to point out the value of certain differences in the form of the rachis for use in classification.

The form of the panicle is largely determined by the position of the branches. In all varieties the branches arise from various sides of the rachis, but later the branches may assume different positions, thus causing the different panicle shapes. The branches of the equilateral panicle extend from the different sides of the rachis at various angles (fig. 10). Usually the lower branches on the panicle are the longest, with a gradual shortening toward the apex with each successive whorl, the general form being roughly pyramidal. The branches may be short or long, and this character determines in part the size and stiffness of the panicle. Where the branches are long and drooping, the term "lax" has been used to describe the panicle, and where they are usually short but rather ascending in their position, the descriptive term "compact" has been used.

FIGURE 9.—Oat panicles: *A*, Equilateral, and *B*, unilateral. (× ⅔.)

FIGURE 10.—Equilateral panicles of oats, showing the 3 attitudes of branches: *A*, Erect, *B*, spreading, and *C*, drooping. × ⅓.

These terms are rather indefinite and thus have been used only sparingly in the general descriptions of some of the varieties with equilateral panicles. In the unilateral panicle, however, the branches and spikelets definitely turn to one side of the rachis and extend more distinctly upward, which has led to the use of the descriptive terms "pectinate" and "reconfused" ("appressed"). These terms are used in this bulletin in describing the position of the spikelets and branches primarily in the side oat varieties (fig. 9, *B*).

In general, the number of whorls of branches (usually 4 to 7) is the same in the two panicle types.

PLACE OF ATTACHMENT OF LOWER WHORL OF BRANCHES

Etheridge (*61, pp. 116–117*) pointed out the value of certain differences in the origin of the lower whorl of branches in the rachis for the identification of certain varieties. In a number of varieties, particularly in the group with side panicles, this lower whorl arises at a geniculate bend, or secondary node, in the rachis, and not at the first, or lower, rachis node as is common in most varieties. Marquand (*107, p. 9*) described this character as a false node, and also referred to it as an abnormality. In this bulletin, this character is utilized in grouping varieties, particularly those in which it occurs frequently enough to make it a reliable mark of identification.

The histology of this secondary node, or so-called false node, is not well understood. Etheridge (*61, pp. 116–117*), who was the first author to employ this character extensively for classification purposes, discussed it as follows:

> The peculiar node is very striking. It is situated at a somewhat geniculate bend in the rhachis, and its diaphragm is usually wanting. Lacking a nodal diaphragm, the stem is hollow at this point in contrast to its solidity at normal

nodes. . . . Below the geniculate bend is a normal, although branchless and leafless, node, and the two nodes, although in some cases fused, are usually from one to four inches apart. The branches probably originate at the outlying normal node, but fuse with the stem until finally they issue from the knee-like bend, which thus becomes nominally the first node of the panicle. The diaphragm of the first node is usually, but not always, absent. In some cases, when the first node, or bend, is fused with the outlying node, the diaphragm is present, although often more or less defective; but in such cases the diaphragm thus appearing is doubtless a part of the usual outlying node.

Without special histological studies of its structure, little can be said of this peculiarity of the rhachis . . .

This secondary rachis node rarely occurs except in certain varieties with unilateral panicles or in those developed from them by hybridization. In such varieties as Storm King, Tartar King, and Black Rival this character is a fairly constant one, thus affording an outstanding mark of identification (fig. 11).

Marquand is correct in referring to this secondary rachis node as an abnormality. The writer has observed that a false node frequently is present in varieties with tree panicles, such as Silvermine and Victory, that are heavily infected with smut as the result of artificial inoculation. This character, therefore, can be induced by factors disturbing the normal development of varieties that otherwise never show any indication of a false node.

SIZE

In this bulletin, oat panicles are grouped into three sizes: Small, midsized, and large. While this character is markedly influenced by environment, it has been observed that there is a relative difference in the size of panicle under normal conditions of soil and climate. It is a well-known fact that varieties such as Kherson and its derivatives as a rule have small panicles. Other varieties invariably produce large panicles, regardless of environment. The panicles of intermediate size are designated as midsized. Although the size of panicle is of little use in identification except for comparative purposes, it has been used by nearly all investigators for general descriptions.

Length

Length of panicle also is used to separate varieties. Panicles are described as short, midlong, and long. Most varieties have midlong panicles. This character, like that of size, is only relative and is of minor value for identifying varieties, except those having very large or very small panicles.

Width (Breadth)

The width (breadth) of panicle is designated as narrow, midbroad, and broad. Panicle width depends largely on whether the branches are erect or spreading in habit. The term "narrow" applies particularly to most varieties of side oats, i. e., those having a unilateral panicle. Most varieties of the equilateral group have midbroad panicles, whereas only a few have either broad or narrow panicles.

Form (Shape)

"Ovate" is used as a general term to describe the roughly pyramidal shape of the panicles in the type designated as equilateral, or tree, oats.

POSITION OF BRANCHES

The position of panicle branches are described as ascending, spreading, and drooping for tree oat and as pectinate and confused for side oat.

In some varieties the branches are always distinctly ascending. In others they form an angle with the

FIGURE 11.—Oat panicles with normal and abnormal rachis nodes: A and C, Lower whorl of panicle branches arising at lower, or normal, rachis nodes; B and D, lower whorl arising at secondary nodes (geniculate bends), or so-called false nodes, in the rachis with normal leafless and branchless nodes just below. [illegible]

rachis. In still others, the branches are distinctly drooping; that is, the end of the branch is considerably lower than the point of its attachment to the rachis. The terms "pectinate" (one-sided) and "confused" have been used to describe the position of the branches and spikelets of the side oat varieties. In most of these varieties the term "pectinate" is applicable, but in others where some of the branches and spikelets do not fall distinctly to one side, the term "confused" has been employed. The term "semisided" also is sometimes used where an inter-

mediate condition exists between the two types.

RACHIS

The rachis forms the central axis of the panicle, or, as sometimes described, it is that part of the stem running through the panicle. There are two rachis characters of value in classification; namely, (1) a twisted, or flexuous, form, and (2) the occurrence of an additional, or secondary, node. The number of rachis nodes is of little value for classification, as this character is surprisingly uniform among all varieties. Usually, however, early varieties with short straw and small panicles have one less whorl of rachis branches than do late varieties with tall straw and larger panicles.

In all varieties the rachis is more or less flexuous. There are a few varieties, however, in which the rachis is decidedly flexuous and constitutes an additional mark of identification (fig. 12).

SPIKELET CHARACTERS

The spikelet of the oat plant is made up of the glumes (called empty glumes by some earlier writers) and the florets, which form the seed with its caryopsis when mature. In naked oats, the number of florets usually varies from 5 to 7, although 10 have been observed. In the red and common oats the spikelet may contain 1, 2, 3, or even 4 florets, although most varieties produce 2 to the spikelet, the third in most cases being staminate only, or imperfect. The spikelet proper is produced on the enlarged end of the slender, drooping pedicel which connects the panicle branch and the lower, or first, floret. The manner of separation of the first floret (grain) of the spikelet from its basilar connection, or pedicel, and the second floret from the first or primary floret, is a most valuable

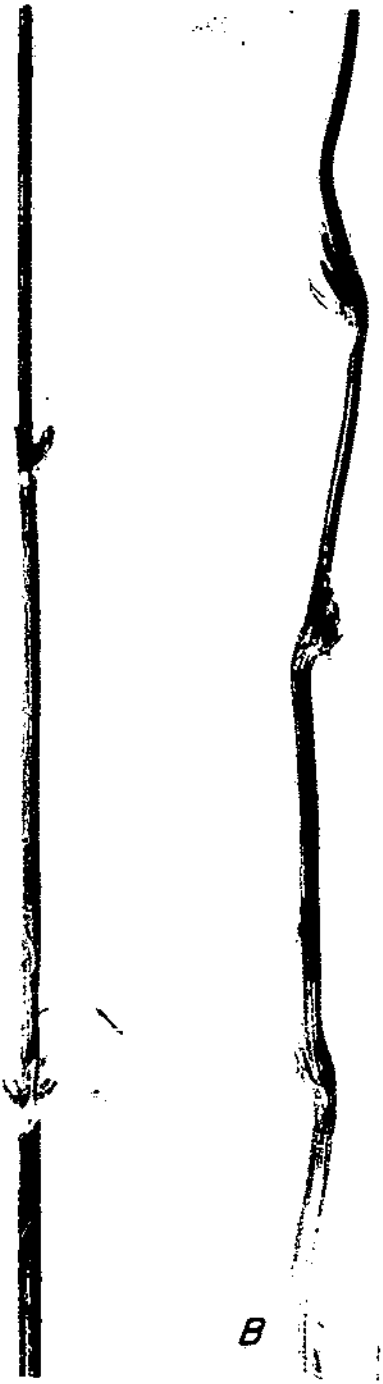


FIGURE 12.—Flexuousness of rachises in oat panicles: *A*, Straight, and *B*, flexuous. (× 3.)

character for classification. Floret separation, alone, differentiates between *Avena sterilis*, the wild red oat, and its supposedly cultivated derivative, *A. byzantina*, on the one hand, and *A. fatua*, the common wild oat, and its supposedly cultivated derivative, *A. sativa*, on the other hand. These characters are described in this bulletin as spikelet separation (disarticulation) and floret separation (disjunction), respectively.

NUMBER OF SPIKELETS PER PANICLE

The number of spikelets per panicle has been designated as few or numerous. This character is relative and of value only for descriptive purposes. It is greatly affected by environment. Oats of almost any variety when sown thinly in a rich soil with abundant moisture will produce many more spikelets per panicle than when sown thickly in a poor soil under dry conditions. However, in varieties such as Red Rustproof the number of spikelets under normal conditions is always relatively small.

SPIKELET SEPARATION
(Disarticulation)

Coffman, Parker, and Quisenberry (*37*) described the separation of the lower floret of the oat spikelet from the pedicel, or axis, of the spikelet as "spikelet disarticulation" in contrast to "floret disjunction" for the separation of the florets of the spikelet from each other. As these authors point out, the exact morphological structure of the rachilla or rachilla segments is not well understood. In their discussion (*37*, *p. 19*) of spikelet disarticulation, they stated:

> In the wild species, *Avena fatua* and *A. sterilis*, and in most of the cultivated varieties the basal segment of the rachilla usually is short and thickened. Apparently, the basal segment of the rachilla and the projecting basal callus of the lower floret are united obliquely in the lateral plane, the callus being dorsal and the rachilla ventral. In the two wild species named, spikelet disarticulation takes place by means of an oblique abscission layer, apparently located in the cleavage plane between the basal rachilla segment and the callus of the lower floret. It is possible that a true articulation between the base of the lower lemma and the apex of its supporting rachilla segment exists above this abscission layer, and that this abscission layer is formed in the tissue of the rachilla segment itself, but this is very improbable. Separation at this layer in that case would leave a portion of the basal rachilla segment attached to the lower floret. . . . In *Avena sterilis*, *A. fatua*, and some of their cultivated derivatives, the separation at this definite oblique abscission layer leaves a well-defined deep oval cavity, commonly called the scar, or "sucker-mouth," in the face of the callus. A corresponding but shallower depression remains in the face of the disjoined basal segment of the rachilla.

They (*37*, *p. 20*) described the three methods by which spikelet separation takes place as follows:

> . . . (1) abscission when the method of spikelet separation was that characteristic of the wild *Avena fatua* or *A. sterilis*, that is, resulting in a pronounced cavity or scar in the base of the lemma; (2) fracture when the method of separation was that most characteristic of the cultivated varieties of *A. sativa*, that is, resulting in roughened tissue with no observable cavity or scar at the base of the lemma; and (3) semi-abscission when the method of separation was to some extent intermediate between the two, apparently resulting partly from abscission and partly from fracture, and leaving only a slight and often poorly developed cavity or scar in the base of the lemma.

In the present classification studies, the terminology as used by Coffman, Parker, and Quisenberry (*37*) and by Coffman and Stanton (*38*, *pp. 1066–1067*) has been modified. The term "spikelet separation" is used in preference to "spikelet disarticulation," as the terms "disarticulation" and "disjunction" are easily confused. Thus spikelet separation occurs by abscission, semiabscission, and fracture (fig. 13). Fracture separation

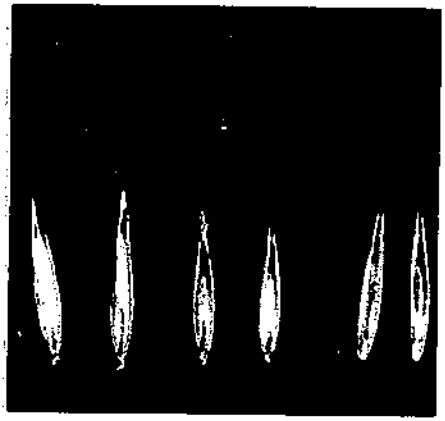


FIGURE 13.—Types of spikelet separation in oats: *A*, Abscission; *B*, semiabscission; and *C*, fracture. (× 5/6.)

is only of value in identifying the varieties of the red oats (*A. byzantina*).

FLORET SEPARATION
(Disjunction)

In the common oat (*Avena sativa*), the rachilla segment (or rachilla as used by most authors) is retained on the lower floret, the rachilla segment separating by a more or less imperfect disarticulation at the base of the second floret. This separation, however, has been shown not to be a perfect disarticulate joint (*37*), and ordinarily the break, or separation, occurs with but little pressure. While there is not a distinct disarticulation, there seems to be a weakness that causes it to separate nearly always at that point. On the other hand, the rachilla segment in the red oat varieties (*A. byzantina*) is almost invariably retained by the upper floret, and on separation the fracture occurs at the base or about midway of the rachilla segment. Considerable force is required to separate the upper and lower florets in red oats, as can be noted frequently in threshed grain samples.

Definite floret separation by disarticulation does, however, exist in the wild oat (*A. fatua*), the supposedly wild progenitor of *A. sativa*. In this wild form, the upper and succeeding florets separate from their rachilla segments by disarticulation immediately upon ripening (*37*, *38*).

Coffman, Parker, and Quisenberry (*37*, *p. 20*) stated that:

> In some species, as *Avena fatua* and its derivative *A. sativa*, disjunction of the second and additional florets usually takes place by disarticulation at the apex of the rachilla segment. In such cases the rachilla segment remains attached ventrally at the base of the next lower floret of the spikelet. The attachment of the rachilla segment to the base of the second and subsequent florets is very firm in *A. sterilis* and its derivative *A. byzantina*. The florets of the spikelet often remain attached together during threshing. When forcibly separated, the segment breaks near its base, as pointed out above. But in *A. sativa* the separation by disarticulation at the base of the floret usually takes place very readily.

Coffman and coworkers (*36*) described the nature of the separation of the supporting rachilla segment as (1) disarticulation, when the second rachilla segment disarticulates from its floret, as in *A. fatua*; (2) basifracture, when disjunction is by fracture at the lower end of the second rachilla segment and it remains attached to the second floret, as in *A. byzantina*; and (3) heterofracture, when the second rachilla segment fractures irregularly at about the middle, and disjunction or separation cannot be classified definitely.

The terminology for the purpose of the present study has been slightly modified. The term "floret separation" is used preferably to "floret disjunction." Floret separation, therefore, has been observed to take place by disarticulation, as is found in common varieties; basifracture, as is found in the red oat varieties; and heterofracture (intermediate) when the rachilla segment breaks at an intermediate point as is fre-

quently found in hybrid varieties between common and red oats. This third type of floret separation is of special value in the separation of jordanons within *A. byzantina* varieties, and is of little use for the separation of varieties. The three types of floret separation are shown in figure 14.

FIGURE 14.—Types of floret separation in oats: *A*, Disarticulation; *B*, heterofracture; and *C*, basifracture. (Detached second florets below.) (× 5½.)

It is of interest to note here that the types of spikelet and floret separation found in several species of *Avena* have been recently described by Musil (*115*) (fig. 15) and are in rather close agreement with those published by Coffman, Parker, and Quisenberry (*37*, *pl. 1*).

GLUMES

The glumes (empty) consist of the two outer membranous appendages that surround the inner glumes, or lemmas, making up the spikelet proper. They are broadly lanceolate, pointed, boat-shaped, usually glabrous, and somewhat arched. The lower glume is just a little shorter than the upper one, and both are always somewhat longer than the lemma, or flowering glume, except in naked oats.

The characters of the glume employed for classification in this bulletin are length, width, number of veins, and color. The relative length and width of the glumes vary somewhat in oat varieties. These characters are not of particular value except where the glume is exceptionally short or long. Marquand (*107*, *p. 32*) used the glume character for the identification of the Marvelous variety that usually produced glumes exceeding 30 mm. in length. The number of veins in the glume ranges from 7 to 11. No great emphasis, however, can be placed on this character as the number varies as much within varieties as between varieties.

Likewise, the color of the glumes as a whole is not a satisfactory differentiating character. Although there is a variation from light green to dark green in immature spikelets, this difference is applicable to the leaves and other parts of the plant as well. It is of value only in separating the varieties at about the time of full heading, when the color is most fully developed.

LEMMA CHARACTERS

The lemma, sometimes called the flowering glume or husk, with its palea encloses the floral organs that later develop into the caryopsis, or seed. In cultivated oats, with the exception of naked oats, these integuments of the caryopsis usually do not separate from it in threshing. The palea is a thin, membranous tissue of no value for classification of varieties, except that it is dark colored in a few varieties. In such varieties, this color may be used as an additional, minor mark of identification. However, several

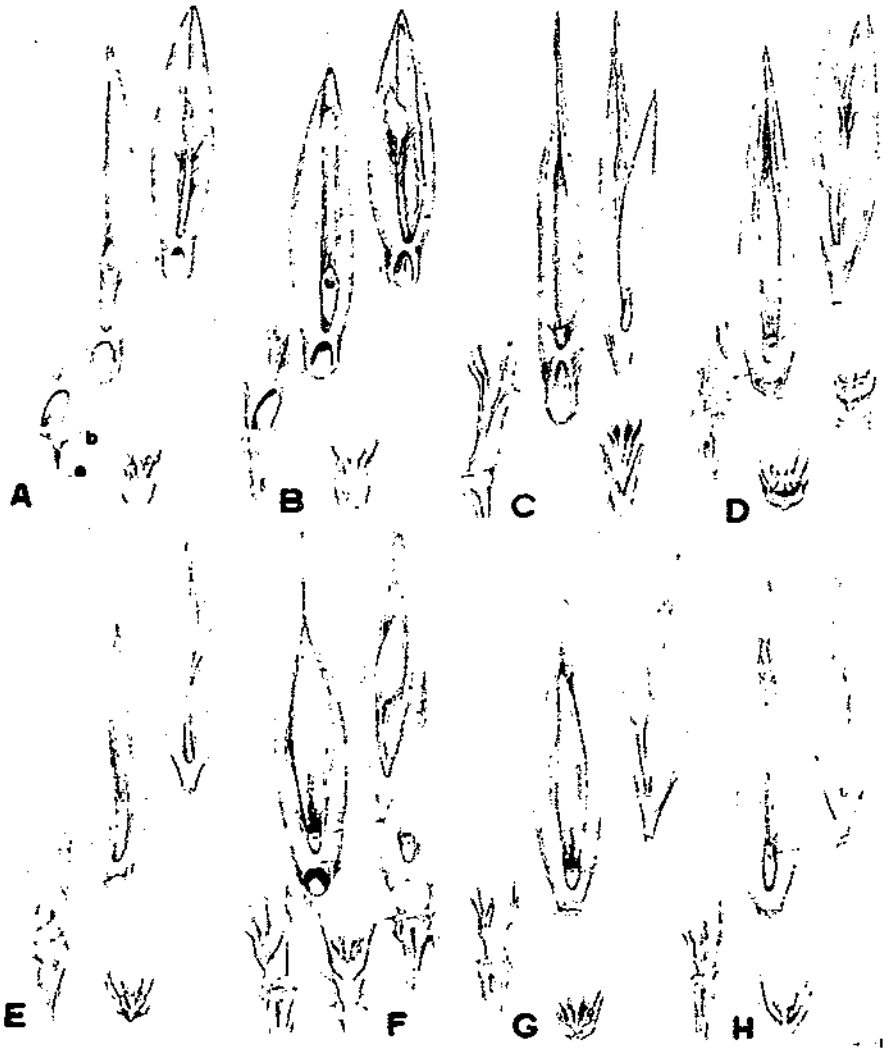


FIGURE 15.—Mode of spikelet and floret separation (somewhat stylized) in several species of wild (including fatuoid) and cultivated oats. (After Musil.)

other characters of the lemma (grain)—color, length, shape, hairiness, basal hairs, second floret rachilla segment, and awn—are of much importance in classification.

COLOR

The color of the matured lemma (grain) has been used by practically all investigators in the classification of oat varieties. Most investigators, including Etheridge (*61*), Marquand (*107*), Archer (*6*), De Villiers and Sim (*51*), and others have recognized color of lemma or grain as a major character in classifying oats, particularly in the cultivated varieties. Others believe that it is of local importance only for classification purposes. In the present investigations, color is recognized as being a distinct and reliable major character when the variety is grown under normal con-

ditions of soil and climate, such as is characterized by favorable seasons in the better northern oat sections of the United States. A satisfactory classification is impossible if the color fails to develop fully. The colors here recognized are black, red, gray, yellow, and white (pl. 2).

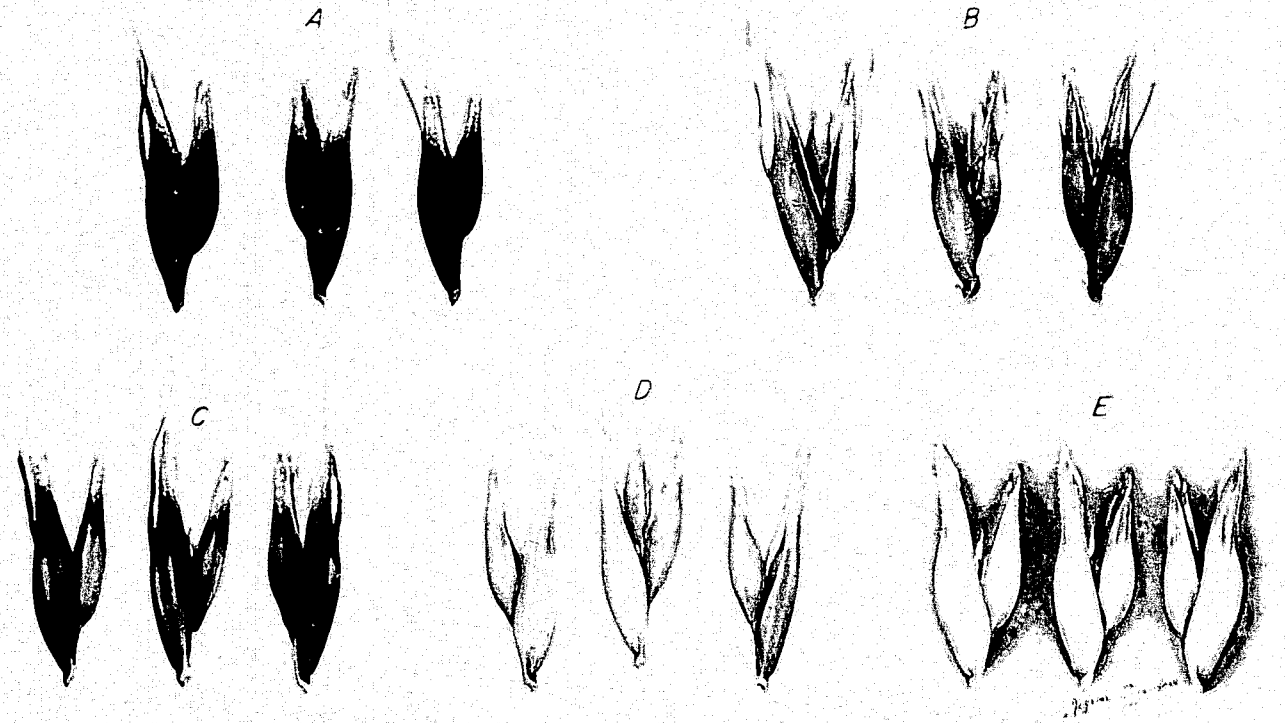
For convenience, Etheridge (*61, p. 107*), placed the cultivated varieties into two large groups, (1) dark-colored (black, brown, red, and gray) and (2) light-colored (white and yellow). In the present study the writer has not found this major separation necessary, as certain colors like brown and black and yellowish white and white are more or less transitional, depending upon the environment under which they are grown. Consequently, all varieties showing black pigment in varying degrees are considered as black oats, although some varieties are normally inherently brown rather than black. Many varieties with black lemmas often show only a trace of black or brown pigment when prematurely ripened by drought or other natural causes.

Red, as usually referred to in oats, is a reddish-yellow color rather than a distinct red and is used in this classification to designate more particularly the varieties of so-called red oats. This color is best characterized by that of the Red Rustproof variety, when normally matured without discoloration. Gray is equally as distinct a color, but this must be noted carefully, as gray varieties have been classed as white where the environment was not favorable to the development of color in oats. Yellow, likewise, is distinct in many varieties and can be differentiated from yellowish white to white as a color, as there are truly yellow varieties. Yellowish white to white as a color when not weather-stained is distinct from yellow. In fact, the color yellowish white to white might be separated, as there are certain varieties which are yellowish white and others that are more distinctly white. Such a differentiation, however, would result in confusion because of the blending of one color into the other. The primary colors are fairly constant in the oat, but are easily influenced by climatic conditions; therefore, often the conditions under which the oat was grown must be taken into consideration. For instance, Victory, a typical white oat, when grown in the Puget Sound area of Washington State develops a distinct reddish (copperish-yellow) color. This effect of environment is very misleading, as Victory oats from this area frequently are sold under the trade name "Puget Sound Golden."

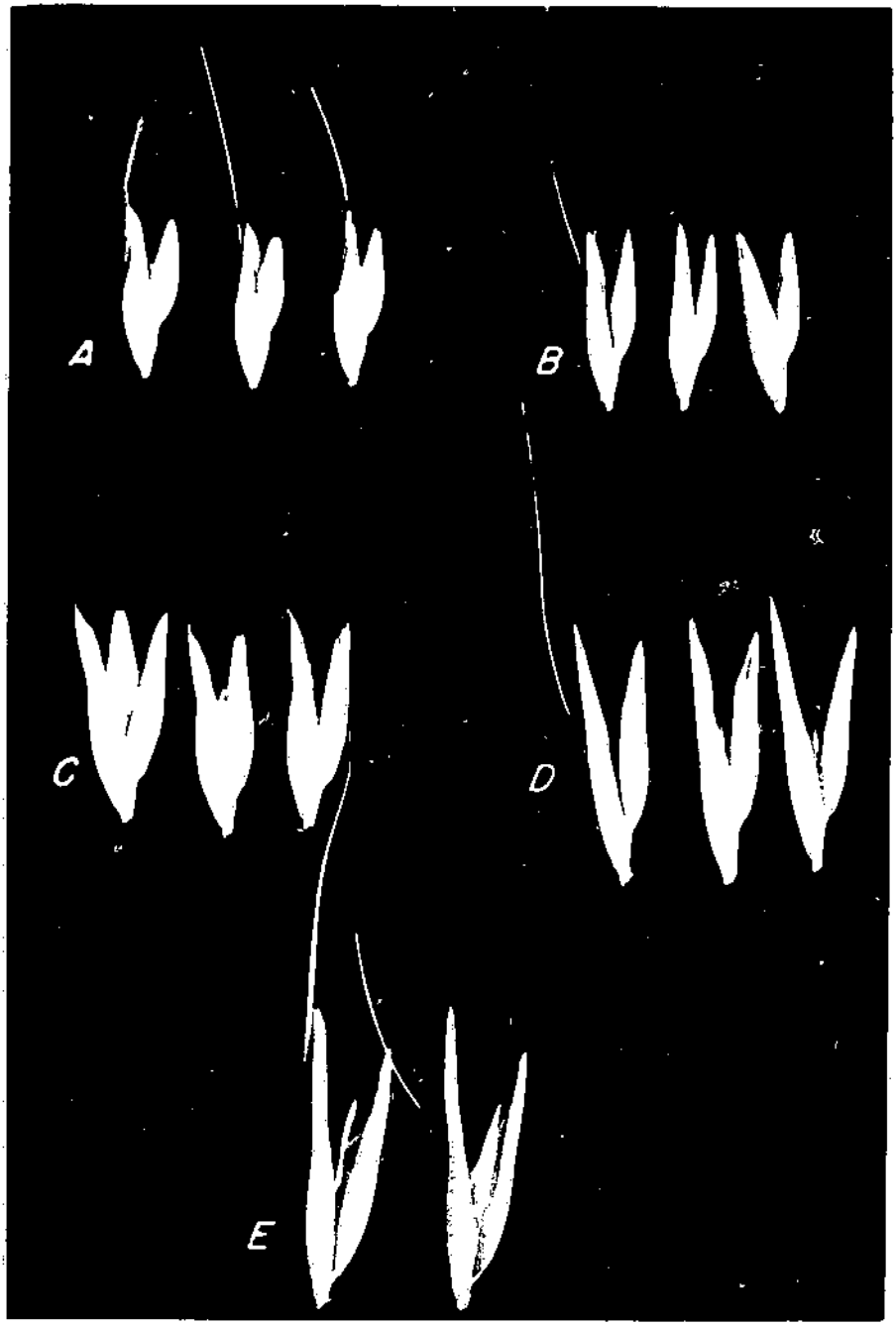
SIZE

The two measures of lemma size considered are (1) length and (2) thickness. It is definitely recognized that measurements of lemma are variable between certain limits, nevertheless there is a distant difference in the length of lemma among oat varieties. Etheridge (*61, pp. 107–108*) doubted the usefulness of length of lemma in classification, but he listed it several times in his key in order to separate certain varieties otherwise similar. In the present classification, the following terms for general description of lemma (grain) length (fig. 16) have been used: Very short, 8 to 12 mm.; short, 13 to 15 mm.; midlong, 16 to 18 mm.; long, 19 to 21 mm.; and very long, 22 to 26 mm. In the case of the wild red oat it has been necessary to describe the lemmas as extremely long; that is, over 26 mm.

It is realized that length of lemma may vary from one of these classes to another, but a variety with a short lemma will be normally short and a variety with a



Lemma colors in oats: *A*, Black; *B*, red; *C*, gray; *D*, yellow; and *E*, white, representing the basic colors as found in the Black Tartar, Red Rustproof, Garton Gray, Richland, and Belyak varieties, respectively, when grown under the environment of Aberdeen, Idaho. (About 1¼ natural size.)


A
B
C
D
E

long lemma will be normally long. Most varieties have midlong lemmas. This character is of the greatest value for the identification of varieties with extremely short or extremely long grains.

SHAPE

Investigators as a group have refrained from using the shape of grain in classifying oats, primarily because of the influence of different environments and seasons. But there is a distinction in the shape of grain that cannot be altogether ignored. Grains vary in shape and circumference. Shape, like length, of grain is relative and can be used only for identification purposes in those varieties representing the extremes. In this study the five shapes of grains used are: (1) Very slender, (2) slender, (3) midplump, (4) plump, and (5) very plump. The three principal shapes are shown in figure 17. These are relative terms and are useful primarily for descriptive purposes, and for the identification of varieties on the basis of grain samples.

HAIRINESS

The lemmas of most of the minor and wild species of *Avena* usually are beset with hairs. In cultivated oats, on the other hand, the lemmas are hairless except for a few varieties that constantly produce a few hairs on the lateral and dorsal surfaces of the lemmas. The terms "glabrous" and "hairy" (pubescent) are used.

BASAL HAIRS

The presence or absence of basal hairs frequently has been used as a means of identifying and describing varieties of oats. Several foreign investigators whose work has been reviewed by Etheridge (*61*) used rather elaborate systems in classifying the different kinds of basal hairs, but these systems are of little value. Etheridge (*61*) and Marquand (*107*) did not discuss importance of the basal hairs, but Archer (*6*) made use of this character for identifying varieties otherwise similar. Coffman, Parker, and Quisenberry (*37*) and Coffman and Stanton (*38*) discussed them as numerous, long; numerous, midlong; few (disregarding length); and absent. This classification is very similar to that of Zade (*213*). Although this grouping is satisfactory for treatment of the basal hairs occurring in strains of Burt and Kherson oats, it is not altogether satisfactory for use in the classification of many varieties, as all classifications of basal hairs must

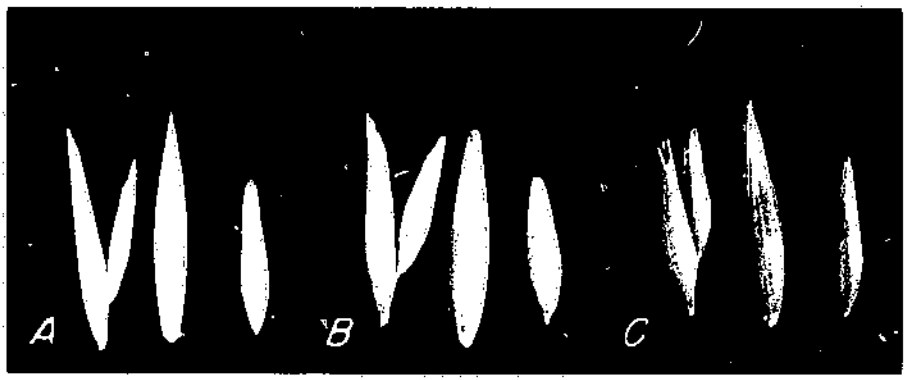


FIGURE 17. Shape or plumpness of grains of oats: *A*, Slender, *B*, midplump; and *C*, plump. (× 1½.)

be somewhat arbitrary. The classification used by Etheridge (*61*) is probably the most satisfactory that has been devised. However, it is not inclusive enough to describe the extent and variation in basal hairs observed in the varieties described in this publication. Hence, the more elaborate scheme of describing the basal hairs has been used as follows: Basal hairs present—(1) numerous, long, midlong, and short; (2) several to numerous, long, midlong, and short; (3) several, long, midlong, and short; (4) few to numerous, long, midlong, and short; (5) few to several, long, midlong, and short; and (6) few or absent. The length of the basal hairs are classed as long (2.5 to 4.0 mm.), midlong (1.5 to 2.5 mm.), and short (0.5 to 1.5 mm.).

Basal hairs, as a rule, are rather conspicuous and a few usually can be found in most varieties. They are best observed at about the time of flowering or a little later. It is not safe to classify oats for this character after the grain has been threshed, or handled roughly, as the hairs are usually easily removed. The major classes of basal hairs as used in this study are shown in figure 18.

SECOND FLORET RACHILLA SEGMENT

The second floret rachilla segment normally is narrow and slightly clavate in shape and may be somewhat flattened, rounded, or furrowed.

Certain foreign investigators, whose elaborate systems have been reviewed by Etheridge (*61*), have made extensive descriptions of the different forms of the rachilla segment. However, in the present study, these minute characters of the second rachilla segment have not been found to be of particular value for varietal identification. The character of most value for classification purposes is length. Etheridge (*61*, *p. 102*) stated:

> Of the characters of the rhachilla here mentioned, none have been considered worthy of use except hairiness, length, and, in some varieties, the partial envelopment of the rhachilla by the lemma.

The function of the rachilla segments connecting the florets of the spikelet and its important role in classification have been fully discussed under floret separation.

Length

The length of the second floret rachilla segment are herein described as follows: Short (0.5 to 1.5 mm.); midlong (1.5 to 2.5 mm.); long (2.5 to 4.0 mm.); and very long (4.0 mm. or greater) (fig. 19). In most varieties the length of the second floret rachilla segment may be described as midlong, and, like many other quantitative characters, the extremes as to short or long second floret rachilla segments occur only in a relatively few varieties. In naked oats, however, the rachilla segments for the extra third to sixth florets are extremely long.

Hairiness

The second rachilla segment in many varieties frequently bears short hairs. The presence or absence of these hairs have been described as follows: Glabrous (nonhairy), sparsely hairy, and hairy (fig. 20). For certain varieties these characters give a reliable supplemental mark of identification. The length of hairs has been found of little value for classification in this study. Likewise the partial envelopment of the second rachilla segment by the more or less inrolled edges of the lemma, referred to by Etheridge (*61*, *p. 102*), varies considerably with environment and, therefore, has not been used in differentiating varieties.

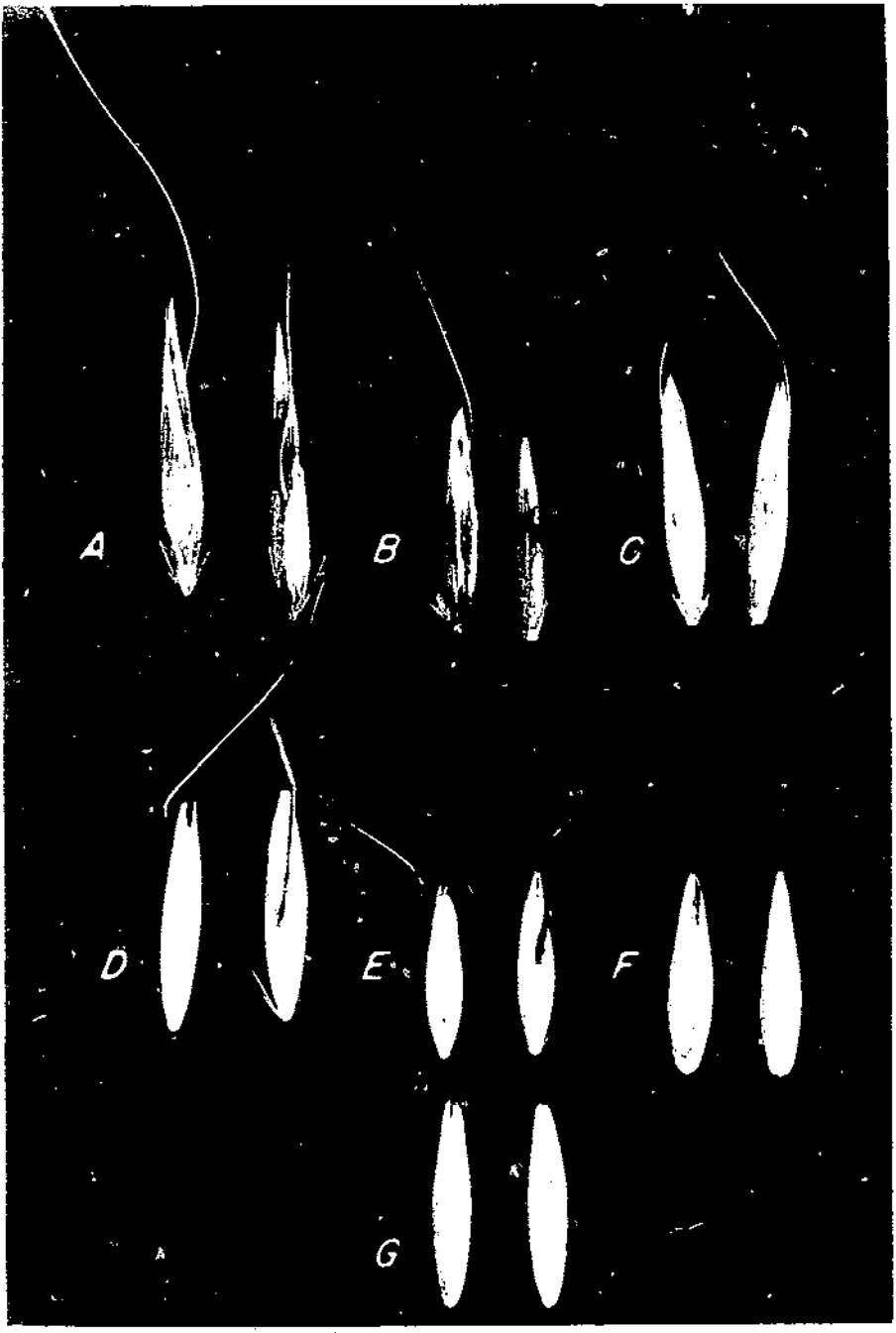


PLATE 18.—Extent and length of basal hairs in oat varieties: *A*, Numerous, long; *B*, numerous, midlong; *C*, numerous, short; *D*, few to several, long; *E*, few to several, midlong; *F*, few to several, short; and *G*, few or absent. (× 1½.)

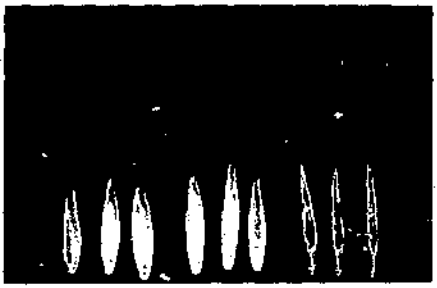


FIGURE 19.—Length of second floret rachilla segments in oats: *A*, Short; *B*, midlong; and *C*, long. (× ⅝.)

FIGURE 20.—Hairiness of second floret rachilla segments of oats: *A*, Glabrous; and *B*, hairy. (× 1.)

AWN CHARACTERS

The awn has been used by nearly all investigators who have classified oat varieties. The value of this character varies with the conditions under which the varieties are grown. The awn, however, is of greatest value and has been used most extensively in the separation of species, rather than of varieties. It appears to have been noted generally that the more primitive the type the more numerous and, usually, the stronger are the awns. Etheridge (*61, pp. 103–104*) has emphasized this correlation and mentions that many of our best cultivated varieties have become almost completely awnless.

In the tribe Aveneae, the awn is an apparent extension of the midrib of the lemma arising from the epidermis at a point usually a little above the middle of the dorsal surface. In the wild forms, awns usually occur on the second and third florets of the spikelet. In these types the awn usually is long and stout with the lower parts twisted in clockwise fashion. Just above the twisted part, the awn is usually kneed, bent or geniculated. In practically all cultivated varieties of *Avena sativa*, the awn occurs only on the first floret. In the more typical varieties of *A. byzantina*, awns usually occur on both the first and second florets and are usually straight or nontwisted. In the exceedingly variable varieties of cultivated red oats, such as Fulghum and Burt, both nontwisted and twisted and geniculate awns occur. Fulghum seldom produces an awn on the second floret and usually on only about 50 percent of the first florets.

EXTENT OF AWNING

The extent of awning or the number of awns present is described as follows: (1) Awns absent (awnless), (2) few or absent, (3) common, and (4) numerous (fig. 21). Varieties that normally and rarely produce no awns under all conditions of climate and soil are described as awns absent (awnless). In other varieties the extent of awning is designated as few or absent, numerous, and common. In the common group the extent of awning is variable in that the awns are commonly present or of frequent occurrence. In some years very few awns may be produced, whereas in others many awns may appear. In this study and for brevity the term "awnless" is occasionally used in the general descriptions to indicate the almost complete absence of awns on the second florets of varieties of the common oat (*A. sativa*).

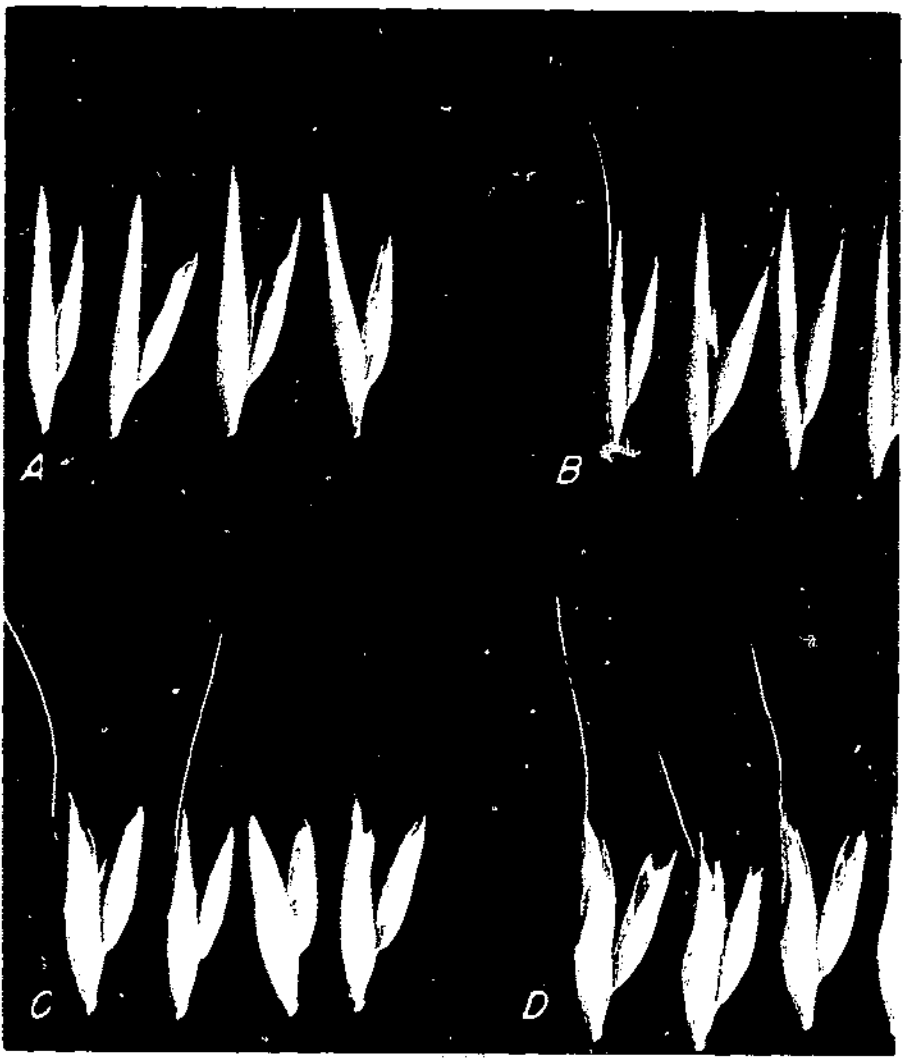
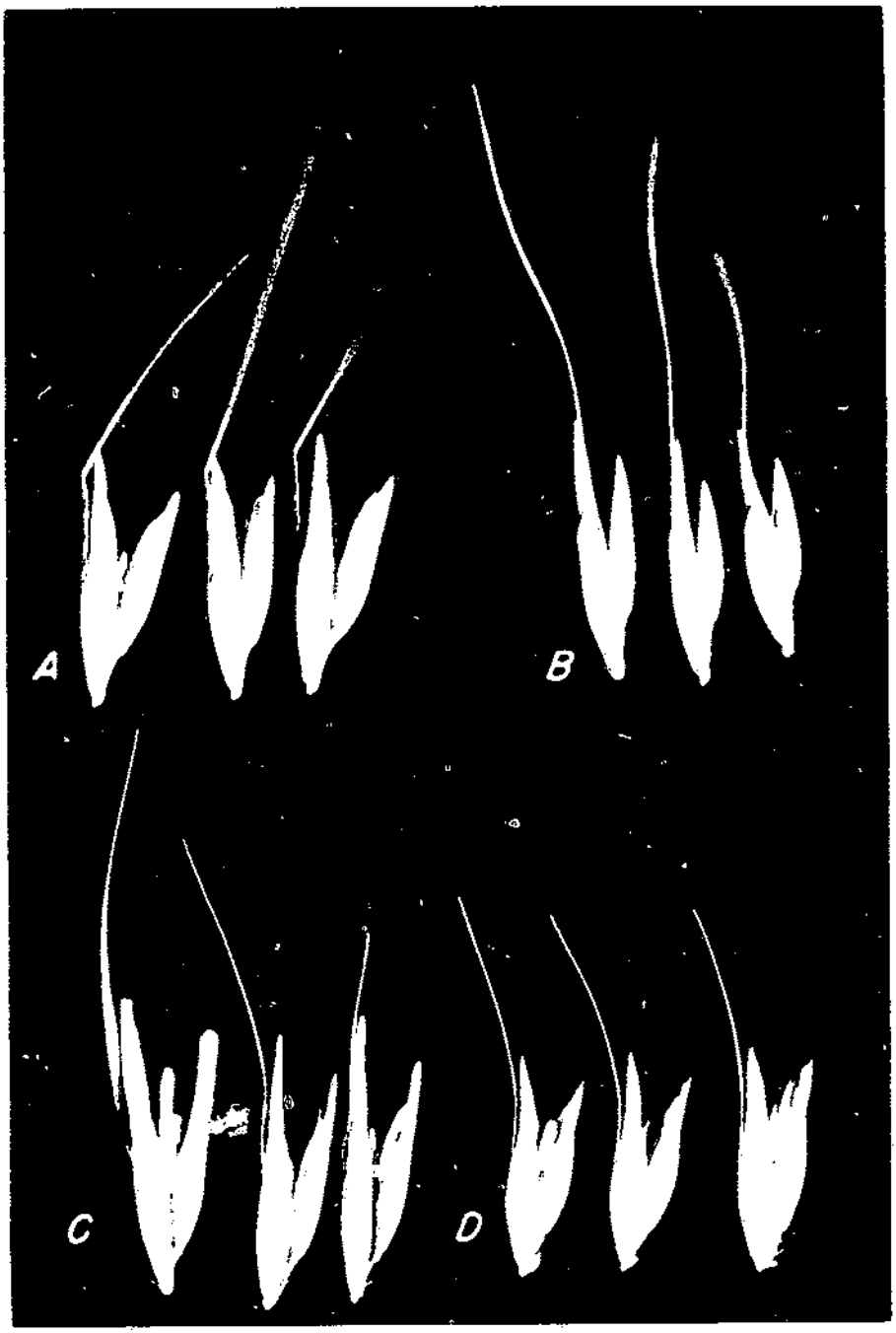


FIGURE 21.—Extent of awning among oat varieties: *A*, Awns absent (awnless); *B*, few or absent; *C*, common; and *D*, numerous. (× 1½.)

TYPE

The form and size of the awns are exceedingly variable and may vary greatly within a variety. The awn, irrespective of length or size, may be nontwisted (straight), or twisted and subgeniculate, or twisted and geniculate (bent). In size it is either short or long, slender or stout. Usually size has been associated with a long, twisted, and geniculate (strong) awns, or short, nontwisted (weak) awns. In the technical descriptions the length of awns is indicated by actual measurement in millimeters.

In this bulletin the awns have been separated into the following groups: (1) Twisted and geniculate (fully kneed); (2) twisted and subgeniculate (half-kneed); (3) nontwisted, long (exceeding 15 mm. in length); and (4) nontwisted, short


A
B
C
D

(less than 15 mm. in length) (fig. 22). The terms "short" and "long" are used primarily in the general description that follows the technical description. The terms "weak" and "strong" are indefinite, although they may be of value for general description. Awn types may vary greatly within certain varieties of *A. sativa* and *A. byzantina*. However, the awns of most of the varieties of *sativa* show some tendency toward twisting. For this reason, it has been necessary to provide two classes for twisted awns, one for varieties that have a rather strongly twisted (twisted and geniculate) awn, of which the Swedish Select is a good example, and another for varieties that have only one or two twists in the awn, and as a result are not fully geniculate (twisted and subgeniculate). The dark coloration on the lower part of the awn in some varieties also appears to be a fairly constant mark of identification, although it may fluctuate more or less with seasonal and environmental conditions. It also is of some value for descriptive purposes.

CARYOPSIS CHARACTERS

The caryopsis, or kernel proper (sometimes referred to as the groat) without its lemma, has been used only by Archer (*6, p. 13*) for describing oat varieties. All previous investigators apparently have considered the characters of the caryopsis usually of little or no value for classification. Archer (*6*) observed that there is some variation in the length of the caryopsis and also in the squareness of the upper end. He also observed that there is a slight difference in the relative length of brush, hairs, or trichomes. Unpublished data obtained by the late V. H. Florell and the writer indicate that there is a variation in size of germ and shape of scutellum. The characters may have some value for the indentification of varieties from grain samples, especially of naked varieties. However, when the caryopsis of many varieties are removed from the glumes it is apparent that little dissimilarity can be discerned.

In the present study, the characters of the caryopsis, except for length, have been found to be entirely too indefinite and minute and, therefore, of no special value for identifying oat varieties. The presence or absence of the remnants of the style might be of value for the classification of certain varieties, but this has not been used in this study. Length of caryopsis is more or less correlated with the length of the lemma. The range in length of the caryopsis is given in the technical description for each variety. The caryopsis with its surrounding glume (lemma and palea) has been referred to as the grain in the botanical descriptions of varieties presented in this bulletin. The morphology of the oat caryopsis as originally developed by Andrew C. Winton is given in figure 23.

FIGURE 23.—Parts of the oat kernel, or groat: (ST) Remnant of style, (T) trichomes, or hairs; (F) fruitcoat, or pericarp; (S) spermoderm, or seedcoat; (N) hyaline layer, or perisperm; (al) aleurone layer of endosperm; (am) amylaceous, or starchy endosperm; (sc) scutellum, or cotyledon of embryo (germ); (ls) ligule of scutellum; (ps) plumule sheath; (p) plumule, or leaf bud; (lh) ligule of hypocotyl; (hy) hypocotyl, or embryonic stem; (r) radicule, or embryonic root; (re) radicle cap; (rs) radicle sheath; (m) micropyle, or opening through which the pollen entered. (× 15.) *Inset:* Aggregates of starch grains in starch cells. (amw) Starch cell walls, (amg) starch grains (numerous polygonal starch grains closely associated constitute the clusters of starch grains). (× 200.) Parts of the lemma or hull: (FG) Lemma, or flowering glume; (P) palea; (R) second floret rachilla segment. (× 15.) (After Andrew R. Winton.)

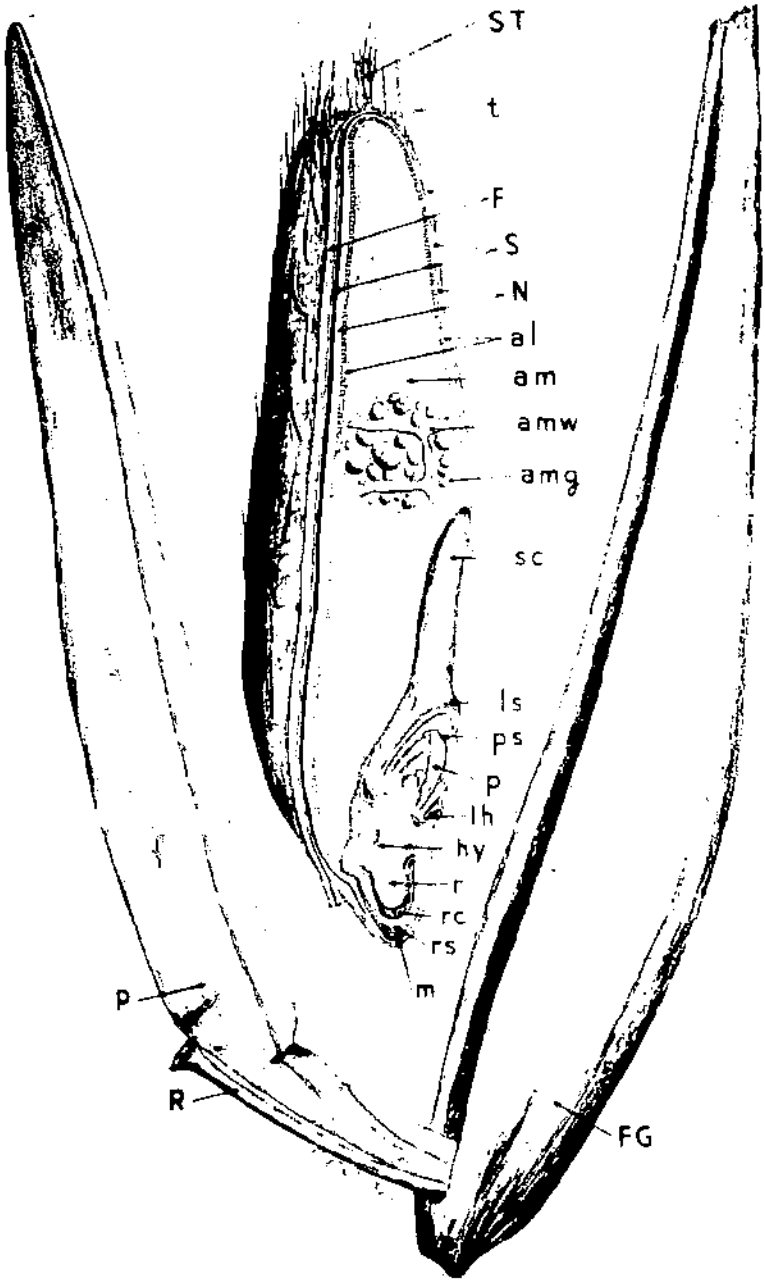


FIGURE 23.—See legend on page 42.

A study of the characters of the caryopsis in some of the species of oats has been made recently by Musil (*115*). Some of the differences in length of caryopsis and brush, shape, tightness of crease, size, and form of scutellum in the specimens she studied are reproduced and shown in figure 24.

FIGURE 24.—Caryopses of some of the species and varieties of oats including farinoids. (After Musil.)

PHYSIOLOGICAL CHARACTERS

Productivity, resistance to cold, and reaction to disease are physiological characters or qualities that may be of some value in the identification of agronomic varieties under certain conditions. Productivity is an expression of the inherent yielding power of a variety, but it is too variable for use in classifying varieties. Strains nearly identical morphologically may differ markedly in average yielding power over a period of years if the strains respond differently to environment or diseases. Productivity, particularly when outstanding in a variety, is mentioned in the general description that follows the botanical descriptions.

RESISTANCE TO COLD

Resistance to cold includes ability of fall-sown, or winter, varie-

ties to survive continued low temperatures and also of spring varieties to survive late-spring freezes. Usually the morphological character of winter habit in early growth is associated with cold resistance. Like productivity, cold resistance is a most important agricultural character but of no value for classification except where the varieties are subjected to differential killing conditions.

REACTION TO DISEASE

Varieties of oats vary greatly in their reaction and relative resistance to the different plant diseases. Reed, Griffiths, and Briggs (*132*) were among the first investigators to show that varieties of oats may vary greatly in their resistance or susceptibility to smut. Stanton, Stephens, and Gaines (*175*) showed that the Markton variety is highly resistant to covered smut. Reed (*131*) and Reed and Stanton (*133*) reported on the occurrence of highly specialized races of the oat smuts that attack only certain varieties.

The reaction of varieties to certain pathogens may be used as a means of varietal identification. Studies by Parker (*123*) and Durrell and Parker (*60*) showed that the reaction of oat varieties to rusts varies greatly. Levine, Stakman, and Stanton (*100*) reported high resistance to stem rust for many varieties, of which several are of great economic importance. Likewise, Murphy (*111*) demonstrated high resistance to crown rust in a few, rather recently introduced varieties. Such information as is available regarding the resistance of some varieties to certain plant diseases has been included in the general description given for each variety. The factor of resistance played an important role in the economic status of some oat varieties, even before such resistance was definitely determined and understood.

CLASSIFICATION OF THE GENUS *AVENA*

The oat belongs to the grass family Gramineae (Poaceae), to the tribe Aveneae, and to the genus *Avena*. There are two divisions of the genus *Avena*: Annuals and perennials. The cultivated oat belongs to the annuals, which group only, therefore, is of interest in connection with the present investigations.

Hackel, in 1890 (*66, pp. 121–123*), stated that there were more than 50 species of oats in the Temperate Zone of the Old World, and a few in the New World. The spikelets of the annuals to which the cultivated oat belongs are drooping, and the glumes are unequal in length and many-nerved. The number of species, excluding subspecies, known and recognized as belonging to the annuals, as a rule, has not exceeded 12, the number depending largely upon the individual opinion of the taxonomist presenting the classification.

In this investigation, no extensive study has been made of the relationships between the different species and subspecies of *Avena*, and, therefore, no new or original scheme for their classification is offered. Considerable difference of opinion with regard to their classification has prevailed among systematic botanists and oat specialists. After reviewing in part the literature on the classification of the genus, it seems advisable for the purpose of this bulletin to accept for the most part the species recognized by the majority of previous investigators and to present a key in which they are arranged in the more or less conventional botanical order. Following

the key, the species and varieties of each are described, the most space being given to those of greatest economic importance. Stanton and Dorsey (*168*) have shown noncompatibility of chromosome number and morphological characters. Malzev in 1930 (*105*) published an extensive systematic classification of the plant forms belonging to section *Euavena*. This work embraces an entirely new scheme of classification of the species, subspecies, and prolos. Suffice it to say that as all American cultivated varieties belong to *A. sativa* or *A. byzantina*, which are considered as subspecies of *A. fatua* by Malzev, an extensive review of his work is not germane to the purpose of this publication.

KEY TO THE SPECIES AND SUBSPECIES

A key, based on limited studies by the writer and available information at present on the species and subspecies of *Avena*, with their chromosome numbers, follows:

KEY TO THE SPECIES AND SUBSPECIES OF OATS

	Common name of species and subspecies	*Chromosome No. (2n)*	*Page*
1a. Paleas loose.			
2a. Second floret and successive rachilla segments very long.			
3a. Spikelets multiflorous (with 3 to 7 florets).			
4a. Panicles midsized to large, equilateral; glumes 15 to 28 mm. long (*Avena nuda* L.).	LARGE NAKED OAT	42	47
4b. Panicles very small, semiunilateral; glumes 16 to 26 mm. long (*A. nudibrevis* Vav.) (*A. nuda* L. ssp. *biaristata* (Alef.) Aseh. & Graeb.).	SMALL NAKED OAT	14	53
1b. Paleas tight.			
2a. Second floret rachilla segments short to long.			
3a. Spikelets usually with 2 to 3 florets.			
4a. Second floret of spikelets separating from first floret by basifracture.			
5a. Lemmas large, hairy, awns very strong, twisted and geniculate (*A. sterilis* L.).	WILD RED OAT	42	54
4b. Second floret of spikelets separating from first floret consistently by basifracture, or not separating consistently either by basifracture, heterofracture (intermediate), or by disarticulation.			
5a. Lemmas midlarge, glabrous; awns weak, nontwisted (*A. byzantina* C. Koch).	RED OAT	42	59
4c. Second floret of spikelets separating from first floret by disarticulation.			
5a. Apex of lemmas with 2 glume points (teeth).			

KEY TO THE SPECIES AND SUBSPECIES OF OATS—Continued

	Common name of species and subspecies	Chromosome No. (2n)	Page
1b. Paleas tight—Continued			
6a. Lemmas short to very long, lanceolate, with midlong to long lemmas (glume) points (teeth).			
Lemmas hairy; pedicels of spikelets short; spikelets separating by fracture or abscission, deciduous.			
Lemmas short to long, hairy (*A. wiestii* Steud.).	DESERT OAT	14	94
Lemmas midlong to very long, very hairy (*A. barbata* Brot.).	SLENDER OAT	28	96
Lemmas glabrous; pedicels of spikelets long; spikelets separating by fracture, not deciduous.			
Lemmas (glume) points (teeth) long, distinct; second floret rachilla segments slightly hairy (*A. strigosa* Schreb.).	SAND OAT	14	98
Lemmas (glume) points (teeth) midlong, less distinct; second floret rachilla segments very hairy (*A. abyssinica* Hochst.).	ABYSSINIAN OAT	28	99
6b. Lemmas very short, blunt with short lemma (glume) points (teeth) (*A. brevis* Roth.).	SHORT OAT	14	101
5b. Apex of lemmas entire or slightly 2-toothed.			
6a. Spikelets separating by abscission, leaving distinct basal scars, deciduous; lemmas usually hairy (*A. fatua* L.).	WILD OAT	42	102
6b. Spikelets separating by fracture, not leaving distinct basal scars, not deciduous; lemmas usually glabrous (*A. sativa* L.).			
Panicles equilateral (*A. sativa* L. ssp. *diffusa* (Neils.) Asch. & Graeb.).	(COMMON) TREE OAT	42	104
Panicles unilateral (*A. sativa* L. ssp. *orientalis* Schreb.).	(COMMON) SIDE OAT	42	179

LARGE NAKED OAT

The large naked oat (*Avena nuda* L.), also known as the hull-less oat, is decidedly unlike any other species except the small naked oat (*A. nudibrevis* Vav.) (*202*), in that the kernels, or caryopses, are loose within the enclosed lemmas (glumes) and paleas, similar to those of wheat and naked barley. In addition, the rachilla segments of the second, third, fourth, and successive florets are extremely long and the glumes (empty) and flowering glumes (lemma) and paleas are alike in texture. These characters definitely distinguish large naked from all other oats.

The origin of the large naked oat has been stated as follows (*152, p. 177*):

The origin of naked oats is not known, though they appear to have come originally from central and eastern Asia. This type of oats was grown in England as early as the middle of the sixteenth century. In some of the older English publications they are referred to as "peel-corn" and also as "skinless oats." Naked oats are now found in the dry Tibetan-Himalaya highlands in Russia and Chinese Turkestan, and in northern and western China. Indications are that they have grown in that part of the world for many centuries, the grain being used quite largely as human food. Practically all of the [introduced] naked varieties received by the Office of Cereal Investigations were collected by the late Frank N. Meyer in the regions mentioned. He reports that they usually were found growing on sterile mountainsides at high altitudes.

Vavilov (*202, p. 175*) in his classical study of the geographical centers of origin of the forms of cultivated oats, discussed the genesis of the large naked oat as follows:

> Moreover, naked large-grained oats, genetically connected with European cultivated oats, characterized by the same number of chromosomes (42) and readily crossed with each other, behaving in the same way to parasitic fungi, belong absolutely to China. Their centre of diversity is to be found in this country and Europe became acquainted with large-grained naked oats through China. The name itself of one of the widely spread varieties, *A. nuda* var. *chinensis*, testifies to the Chinese origin of large-grained naked oats. It is known even from literary data that naked oats were cultivated in China in the fifth century of our era.[1] . . .

[1] Bretschneider. Botanicon Sinicum. Journ. of the North China Branch of the Royal Asiatic Society. Vol. XVI, 1881. Article III. London, p. 78.

Körnicke and Werner in 1885 (*93*) identified five varieties of large naked oats, basing their separation on the form of panicle, i. e., equilateral or unilateral; the number of awns in the spikelet; and the color of the caryopses. Among the numerous seed lots of the large naked oat introduced into the United States, the writer recognized only a few distinct varieties, all of which have equilateral panicles. In addition to these, several new agricultural varieties of the large naked oat have been bred and developed in the United States and Canada from crosses between the Chinese naked and the common (hulled, or covered) oat. These may be considered as an improved naked type. Differences in the panicles, spikelets, and caryopses of the introduced Yenmesh and the improved Liberty (Liberty Hull-less) varieties of large naked oats are shown in figures 25 and 26.

A key to the large naked oat varieties follows:

KEY TO THE VARIETIES OF THE LARGE NAKED OAT

			Page
1a.	Plants early; caryopses 5 to 10 mm. long.		
2a.	Plants short to midtall (70 to 100 cm.); culms usually glabrous or slightly hairy at the nodes.	NAKOTA	51
2b.	Plants midtall to tall (100 to 130 cm.); culms usually hairy at the nodes.	LIBERTY	52
1b.	Plants midseason to late; caryopses 1 to 8 mm. long.		
2a.	Paleas brown; awns few to common on flowering glumes of first florets, nontwisted; flowering glumes 22 to 28 mm. long.	CHINESE	52
2b.	Paleas white; awns numerous on flowering glumes of first and second florets, nontwisted to twisted and subgeniculate; flowering glumes 17 to 24 mm. long.	YENMESH	53

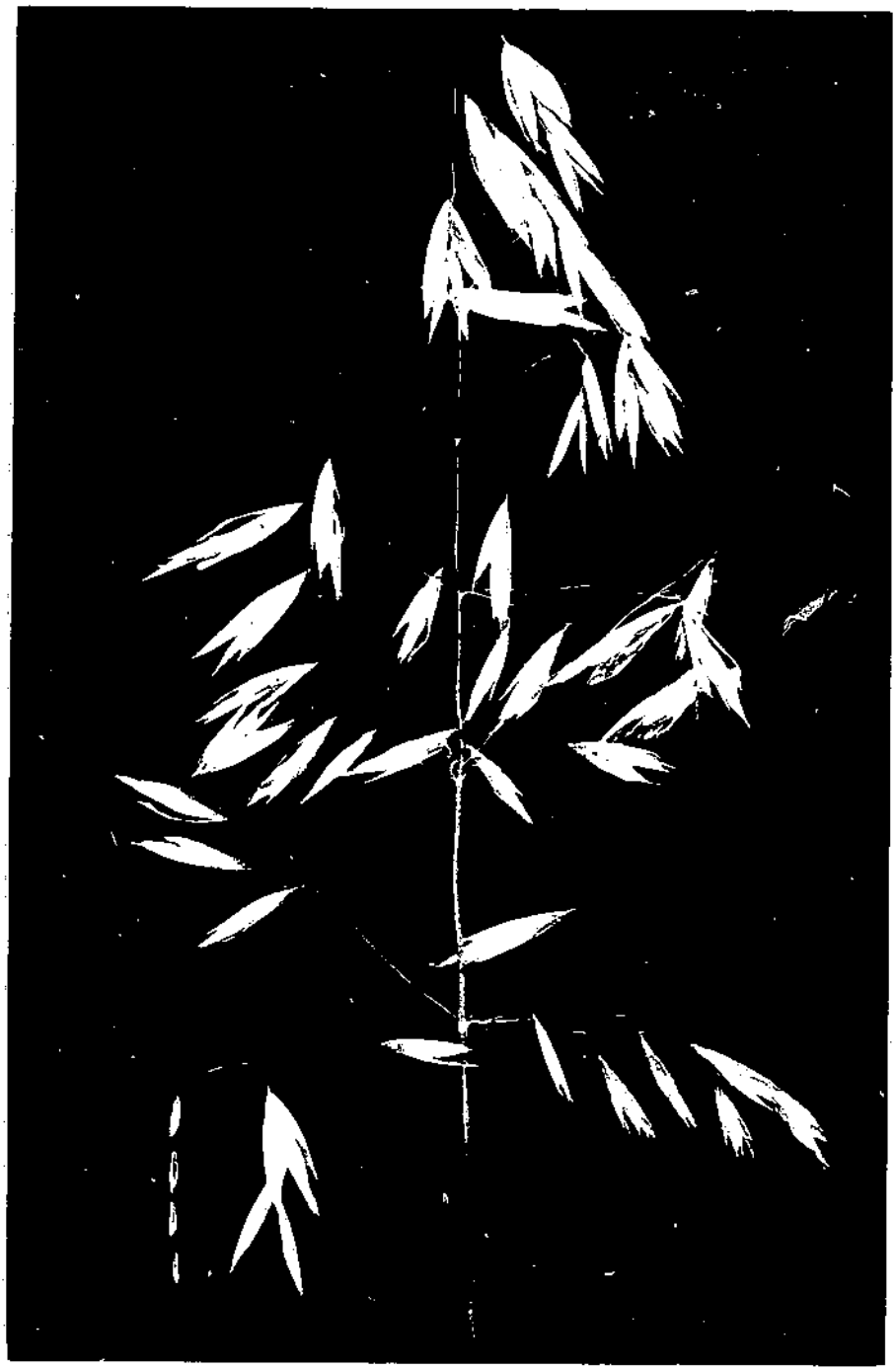


FIGURE 26.—Panicle, spikelets, and caryopses of Liberty large naked oats with few awns and large caryopses. (× ⅔.)

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONOMY OF THE LARGE NAKED OAT VARIETIES

Nakota

Description.—Juvenile growth erect; plants early, short to midtall (70 to 100 cm.); culms small to midsized, fairly stiff, usually glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins ciliate on lower third; peduncles small to midsized, straight, fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate; rachises usually slightly flexuous, nodes 4 to 7; branches short to midlong, ascending or drooping, scabrous; spikelets few to numerous, multiflorous (usually 4- to 6-flowered); outer glumes 20 to 28 mm. long, 5 to 7 mm. wide, 8- to 11-veined, light-green and somewhat glaucous before maturity; flowering glumes of same texture as outer glumes, free from the caryopses, 22 to 30 mm. long, V-notched at apical ends, glabrous; paleas white; basal hairs few or absent; awns few to common on flowering glumes of first florets only, usually nontwisted, 10 to 25 mm. long; caryopses 5 to 10 mm. long, slender; each successive caryopses in the spikelet progressively becoming shorter; second and successive floret rachilla segments glabrous or sparsely hairy, very long (4 to 8 mm.).

The chief distinguishing characters of Nakota are its white paleas, short to midtall plants, and early maturity. Nakota also usually can be distinguished from other similar varieties by the frequent occurrence of a few partly naked or hulled florets on the lower whorl of panicle branches. The hull-less, or naked, character of the variety apparently is not fixed. It is resistant to stem rust and to local races of the loose and covered smuts of oats. Caryopses of Nakota are shown in figure 27, *A*.

History.—Nakota (C. I. 2883) was developed by Matthew Fowlds, formerly of the South Dakota Agricultural Experiment Station at Brookings, from a cross between a selection from Markton and Richland and a selection from Swedish Select and Kilby (a strain of Chinese). The original single crosses, as well as the selections used in the double cross, were made by Matthew Fowlds (*186*). It was first released for growing on farms in the

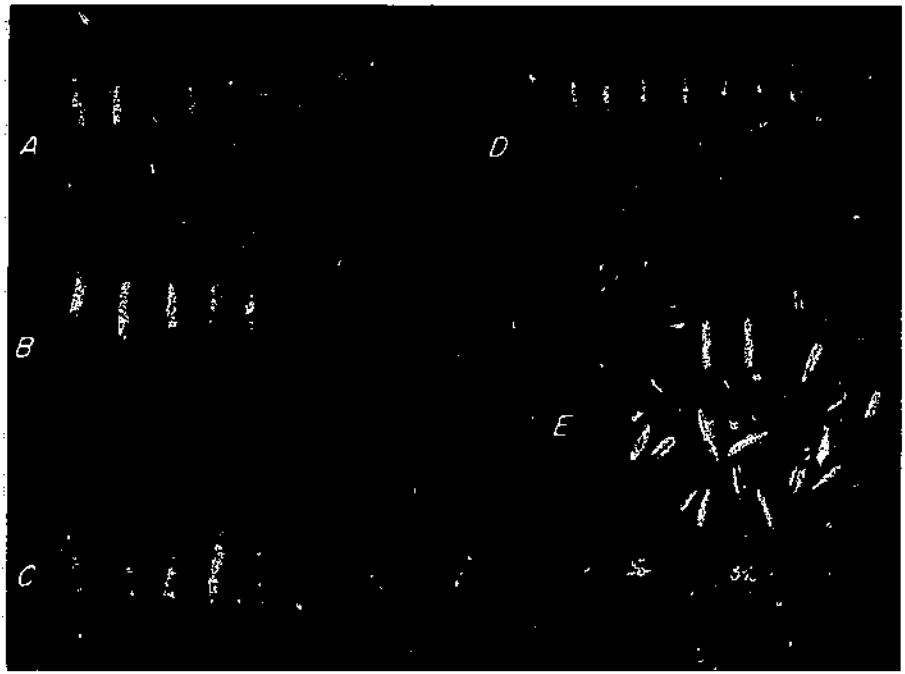


FIGURE 27.—Caryopses of large naked varieties of oats: *A*, Nakota; *B*, Liberty; *C*, Chinese; *D*, Xenmesh; and *E*, caryopses of Vavilov, a small naked oat variety. (× 1.)

spring of 1939, but it has not attained much economic importance.

Fowlds (C. I. 1996) also was developed by Matthew Fowlds at the South Dakota Agricultural Experiment Station, Brookings, from a cross between Swedish Select and Kilby, a strain of Chinese. A sister selection of Fowlds was used as one of the parents of Nakota. Fowlds is similar to Nakota, but is not resistant to stem rust and the smuts of oats. It never attained much economic importance, but apparently is still grown on a few farms in South Dakota (*81*).

Distribution.—Grown to a very limited extent.

Synonym.—South Dakota No. 165.

South Dakota No. 165 has been reported (*186*) as a superior strain of hull-less oats, which, with some further selection and purification, has given rise to Nakota.

Liberty

Description.—Similar to Nakota except for the following characters: Plants midtall to tall (100 to 130 cm.); culms usually more hairy at the nodes. It is very susceptible to the smuts and rusts of oats. Caryopses of Liberty are shown in figure 27, *B*.

History.—Liberty (Liberty Hull-less) (C. I. 845) in 1918 (2) was recorded as a hull-less variety named "Liberty, Ottawa 480." It was produced by crossing Chinese naked with Swedish Select. Saunders (*139, pp. 10–11*) reported that the cross was made in 1903 and that the new variety was introduced in 1917. In June 1936, the writer observed a few fields of this variety in the vicinity of Mount Carmel, Ill. Samples of Liberty also were received from fields in North Dakota. Derick (*49*) gave a brief report on hull-less oats as a specialized crop for Canada.

Laurel (C. I. 2231), according to Saunders (*139, p. 10*), originated from a cross between Banner and Chinese (naked) at Ottawa, Canada, in 1903. It is similar to Liberty in most characters. Under some conditions it is a little earlier and the caryopses are slightly longer. Laurel is now grown on even a smaller acreage than is Liberty.

Diamond (C. I. 2640) is a strain of Liberty apparently placed on the market by a Canadian seed company shortly after Liberty and Laurel were first distributed in Canada. It is of no economic importance in the United States.

Distribution.—Liberty is grown to a very limited extent in Canada and the United States.

Synonyms.—Disco, Disco 22 Hull-less, Liberty Hull-less.

Disco was distributed in 1924 by the Dakota Improved Seed Co., Mitchell, S. Dak., (*45*) under the name of "Disco 22 Hull-less":[4]

> . . . our original stock of Disco 22 Hull-less oats were grown from seed which was sent to us from one of our friends in Canada, and was given the number Disco 22, in view of the fact that it was tested under this number in our nursery plot. We believe that it is similar to the variety known and distributed as Liberty Hull-less oats. . .

Apparently this strain is now little grown on farms.

Chinese

Description.—Juvenile growth erect; plants midseason to late, midtall to tall (90 to 130 cm.); culms small to midsized, weak, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins usually glabrous; peduncles small, straight, fully exserted; panicles equilateral, drooping, midsized, midlong, midbroad, ovate; rachises usually flexuous, nodes 4 to 7; branches short to midlong, ascending or drooping, scabrous; spikelets few to numerous, multiflorous (usually 4- to 7-flowered); outer glumes 20 to 26 mm. long, 5 to 7 mm. wide, usually 9-veined, light-green and slightly glaucous before maturity; flowering glumes of same texture as outer glumes, free from the caryopses, 22 to 28 mm. long, V-notched at apical end, glabrous; paleas brown (black); basal hairs few or absent; awns few to common on flowering glumes of first florets only, nontwisted, 10 to 25 mm. long; caryopses 4 to 8 mm. long, slender, each successive caryopses in the spikelet progressively becoming shorter; second and successive floret rachilla segments glabrous or sparsely hairy, very long (4 to 8 mm.).

Chinese differs primarily from Liberty in having smaller and weaker culms and more slender and slightly shorter caryopses. It also is taller and later in maturity although a less productive variety. Chinese has brownish-black paleas, which makes it genetically a black oat and also gives it a definite mark of identification. Like Liberty, the Chinese variety is very susceptible to the smuts and rusts of oats. Caryopses of Chinese are shown in figure 27, *C*.

History.—Chinese (hull-less) (C. I. 1003) apparently was first introduced

[4] Letter from the Dakota Improved Seed Co., dated February 21, 1925.

into the United States sometime during the first half of the 19th century. Numerous introductions of the variety have been made from China by plant explorers of the United States Department of Agriculture. Strains of the Chinese variety were introduced apparently as a mixture, or in fairly pure form, under the following P. I.[7] numbers: 21231, 21233, 21234, 22005, 22688, 23295, and 48224 (*197*). A. *nuda* Holjer (P. I. 48224, C. I. 1003), used as the type variety in these studies, was introduced from China in 1919. The sample of seed was collected near Kihsien, on the Shansi Plain, by John H. Reisner, University of Nanking, Nanking, Kiangsu, China. Fischer (*62*) apparently was the first botanist to apply the specific name "Chinensis" to this variety. It has been the most commonly exploited variety in the United States until the advent of Liberty (*152*). Chinese has been chiefly a novelty.

Kilby is another named strain under which the Chinese variety has been exploited. This strain was collected by J. A. Kilby of North Yakima, Wash., from Tibetan priests in Chinese Tibet in 1908. While serving as an emergency engineer on the battleship Texas in Chinese waters, Mr. Kilby made an excursion into the interior of China and went as far as Tibet, where he collected a thimbleful of the "Sacred hull-less oats." This seed was brought back to the United States, increased and distributed in Washington State as Kilby (hull-less).

Distribution.—Grown to a very limited extent.

Synonyms.—Bohemian, Chinensis.

The name "Bohemian" was applied to Chinese at the time it was first widely exploited in the United States about 1870 (*152*).

Yenmesh

Description.—Similar to Chinese except for the following characters: Plants midtall (90 to 120 cm.); culm leaves narrow to midwide, margins ciliate; panicles erect; outer glumes 15 to 20 mm. long; flowering glumes 17 to 24 mm. long; paleas white; awns numerous on flowering glumes of first and second florets, usually dark-colored on lower parts, nontwisted to twisted and subgeniculate.

Yenmesh is distinct from Chinese in not growing so tall, in having awns on flowering glumes of the first and second florets, and in having white rather than brown paleas. The awns are usually distinctly dark-colored on the lower parts. The culm leaves also are a little narrower and the panicles are smaller and more compact than those of Chinese. Yenmesh, like Chinese, is very susceptible to the rusts and smuts of oats. Caryopses of Yenmesh are shown in figure 27, *D*.

History.—Yenmesh (C. I. 1759), like the Chinese variety, appears to have been introduced into the United States from China or other Asiatic sources. The strain P. I. 21672, used in these studies, was introduced from I-ch'ang, Hupeh Province, China, through E. H. Wilson of the Arnold Arboretum, Jamaica Plain, Mass., in 1907. This appears to be the same variety classified as "nuda" by Körnicke and Werner (*93*). Seed of Yenmesh has been sold from time to time as a marvelous new variety.

Distribution.—Grown to a very limited extent.

SMALL NAKED OAT

Vavilov (*202, p. 176*) applied the specific name *Avena nudibrevis* Vav. to the small naked oat and stated that this oat is so distinct from the large naked oat that it merits the rank of a full species. He rejected its classification as a subspecies of *A. nuda*, viz, *A. nuda* L. ssp. *biaristata* (Alef.) Asch. & Graeb., and discusses it as follows:

> From the Chinese naked oats it is necessary to distinguish strictly the small-grained naked oats, occurring as weeds, which very seldom are grown as a crop in northern Europe. As our investigations have shown, these forms are readily crossed with *A. brevis* and *A. strigosa* and are immune to parasitic fungi (see Immunity).
>
> These forms do not hybridise either with common oats or with naked large-grained ones. Morphologically they are akin in their vegetative characters to *A. brevis* and *A. strigosa* and, as it might have been supposed according to available data, they belong cytologically (investigations of A. G. Nikolajeva) to the group of *A. brevis* and *A. strigosa* (14 chromosomes). All authors beginning with Koernicke, have erroneously considered them, together with large-grained naked oats, as the species *A. nuda* L. as being naked and many-flowered. We think it more correct to single out these small-grained naked oats into a separate species, *A. nudibrevis* M. This species, together with *A. strigosa* and *A. brevis* constitutes a special group whose genesis may be traced independently from the group *A. sativa*. Both groups show

[7] P. I. refers to accession number of the Plant Introduction Section, Horticultural Crops Research Branch.

parallel homologous series of forms, as is usual in the evolution of plants.

As the small naked oat is markedly different from the other forms of *A. nuda*, the writer has adopted the classification of Vavilov in considering it a separate species. In many characters, the small naked oat is similar to *A. brevis*. *A. nudibrevis* differs from *A. nuda* in growing shorter and in having smaller and more slender culms and panicles, with a tendency toward one-sidedness. The much smaller caryopses of the small naked oat definitely differentiates it from the large naked oat. Furthermore, the small naked oat belongs to the group of species having $2n=14$ chromosomes, whereas the large naked oat belongs in the group of cultivated varieties with $2n=42$ chromosomes. The glumes and awns are a dark reddish brown that is distinct at about the time of full maturity.

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONOMY OF THE SMALL NAKED OAT VARIETIES

Vavilov

Description.—Juvenile growth erect; plants late, short (60 to 80 cm.); culms very small (slender), weak, glabrous at the nodes, nodes brown to reddish-brown; sheaths dark-green, usually glabrous; culm leaves narrow, margins usually glabrous; peduncles very small, straight, occasionally not fully exserted; panicles semiunilateral, drooping, very small, very short, narrow; rachises usually slightly flexuous, nodes 6 to 8; branches very short, ascending somewhat confused in attitude, scabrous; spikelets numerous, multiflorous (usually 3- to 5-flowered); outer glumes 17 to 24 mm. long, 4 to 6 mm. wide, usually 9-veined, light-green and slightly glaucous before maturity; flowering glumes of same texture as outer glumes, free from the caryopses, 19 to 26 mm. long, V-notched at apical end, glabrous; basal hairs few or absent; awns numerous on flowering glumes of first and second florets, nontwisted, 12 to 18 mm. long; caryopses 4 to 6 mm. long, slender; each successive caryopses in the spikelet progressively becoming shorter; second and succesive floret rachilla segments glabrous or sparsely hairy, very long (4 to 8 mm.).

Vavilov is a distinct naked oat. It differs from the varieties of the large-seeded naked oat in having shorter and smaller culms with panicles that are somewhat one-sided and in having much smaller caryopses which are very dormant for some time after harvest (*15, p. 11*). Vavilov is of considerable taxonomic interest. Caryopses of Vavilov are shown in figure 27, *E*.

History.—Vavilov (C. I. 2465) was received by the writer under the name "*Avena nudibrevis*" from the late Ernest Dorsey, Department of Plant Breeding, Cornell University, Ithaca, N. Y., in 1926, with the notation that it was originally received from S. I. Schegalov of Russia. Apparently this form had not been previously introduced into this country. The common name "Vavilov," applied to this variety by the writer since 1939, was chosen in honor of the late N. I. Vavilov, an internationally known botanist and geneticist of Russia who, with his coworkers, first used the specific name "*A. nudibrevis*" for this taxonomically interesting oat. *A. nuda* L. ssp. *biaristata* (Alef.) Asch. & Graeb., the specific varietal name applied to the small naked oat by Alefeld (*4, pp. 319–322*) before it was raised to the rank of a species by Vavilov and coworkers.

Distribution.—None.

Synonyms.—*A. nudibrevis*, *A. nuda* ssp. *biaristata*.

WILD RED OAT

The wild red oat (*Avena sterilis* L.) is believed to be the progenitor of the cultivated red oat (*A. byzantina* C. Koch), as represented by varieties such as Red Rustproof, Red Algerian, and Fulghum. Variations of *sterilis* have been described under the names of "*A. sterilis* L. var. *ludoviciana* (Durieu) Husnot," "*A. sterilis* L. ssp. *macrocarpa* (Moench.) Briq.," and "*A. sterilis* L. var. *maxima* Perez Lara" (*126*).

The lemma of the wild red oat usually is covered with a dense growth of hairs, and both florets of the spikelet bear long, strong, twisted, and geniculate awns, although there is considerable variation in length of lemmas and awns, just as there is in the different culti-

vated varieties. The firm union or adherence of the florets of the spikelet, that is, the mode of separation of the second floret from the first one by basi fracture of the supporting rachilla segment is the outstanding distinguishing character of all subspecies and varieties of *A. sterilis*. This strong adherence of the florets is still present in the more typically cultivated derivatives, by which character they are primarily differentiated from the varieties of *A. sativa*.

The abscission method of spikelet separation is even more pronounced and distinct in the varieties of the wild red oat than in those of the cultivated red oat. At maturity on separation of the lower floret of the spikelet from its pedicel, a very marked basal scar, or suckermouth, remains. The ring of callus, resulting from the abscission layer, is covered with a dense growth of hairs of varying length. Differences in hairiness of lemmas, extent of awning, and size of basal scars as between the very primitive Maxima and the more modified Ludoviciana are shown in figure 28.

The variety or subspecies most frequently received from foreign sources by the United States Department of Agriculture as representing the wild red oat (*A. sterilis* L.) is *A. sterilis* var. *ludoviciana*, which has fewer hairs on the lemmas and apparently is a less primitive form than *A. sterilis* ssp. *macrocarpa*. Trabut (*192–196*) stated that the many forms of the wild red oat probably arose as the result of natural crossing. He also described a number of secondary forms of *A. sterilis*, thus indicating that a wide diversity of types of the wild red oat is found in Algeria and other North African countries.

The writer is indebted to the late V. H. Florell, formerly of the Cereal Crops Section, for calling his attention to varieties of *A. sterilis* growing wild on the campus of the University of California at Berkeley (*63, p. 308*). In this oat, the florets and awns are very large and the lemmas are very hairy, even the awns are hairy in some varieties or strains. This oat appears to be the one described as *A. sterilis* ssp. *macrocarpa* and *A. sterilis* var. *maxima* (*94, 126*), and probably represents one of the more primitive forms of the group. Owing to the extremely long glumes, lemmas, and awns, it usually can be readily distinguished from other wild red oat varieties. These very primitive forms of *A. sterilis* are of much botanical interest because of their great diversity, but are of no agricultural value. For simplicity the specific Latin names "*ludoviciana*," "*maxima*," and "*macrocarpa*" also have been used as common names by the writer.

A key to the wild red oat varieties follows:

KEY TO VARIETIES OF THE WILD RED OAT

		Page
1a. Second florets separating by basi fracture (very persistent); lemmas usually densely hairy; awns long, strongly twisted and geniculate.		
2a. First lemmas very long to extremely long (22 to 30 mm.), somewhat hairy; awns numerous, very long (30 to 40 mm.); second lemmas awns few or absent.	LUDOVICIANA	57
2b. First lemmas extremely long (24 to 40 mm.), very hairy; awns numerous, extremely long (40 to 80 mm.); second lemmas awns numerous.		
3a. Awns glabrous	MAXIMA	57
3b. Awns densely covered with short, fine hairs on the lower parts.	MACROCARPA	58

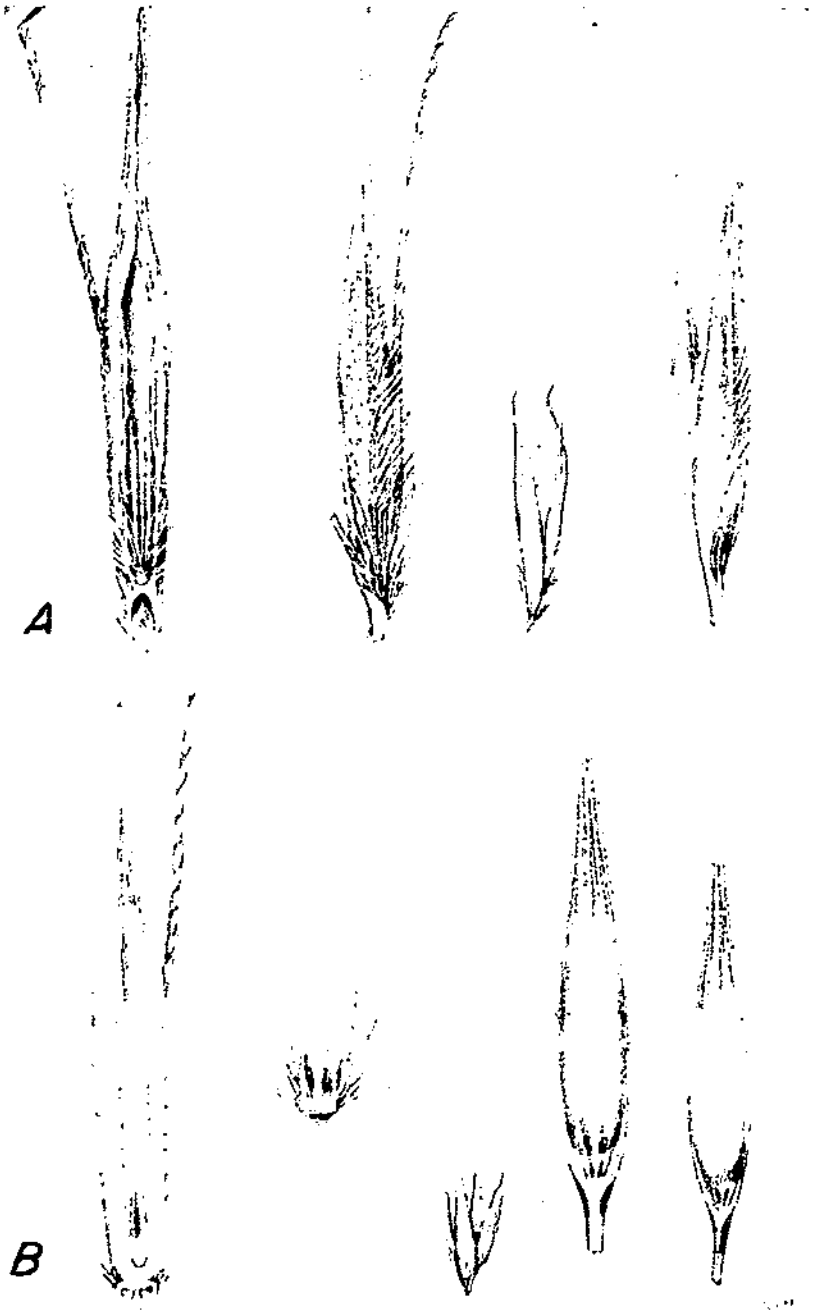


FIGURE 28.—Spikelets and florets of (*A*) Maxima and (*B*) Ludoviciana. (After Musil.)

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONOMY OF THE WILD RED OAT VARIETIES

Ludoviciana

Description.—Juvenile growth erect; plants late, short (50 to 80 cm.); culms midsized, fairly stiff, usually glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves wide, margins glabrous or ciliate on lower third; peduncles midsized, straight, usually not fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate; rachises usually slightly flexuous, nodes 4 to 7; branches midlong, ascending, scabrous; spikelets few, usually 2- to 3-flowered, separating by abscission, leaving midsized basal scars (suckermouths); florets separating by basifracture (very persistent); glumes 30 to 35 mm. long, 7 to 9 mm. wide, 9- to 11-veined, light-green and slightly glaucous before maturity; grains midplump; first lemmas brownish-red; first lemmas very long to extremely long (22 to 30 mm.), somewhat hairy; basal hairs numerous, long; awns numerous, twisted and geniculate, glabrous, 30 to 40 mm. long; caryopses 9 to 11 mm. long; second lemmas 10 to 16 mm. long; awns few or absent, glabrous; caryopses 6 to 9 mm. long; second floret rachilla segments glabrous or sparsely hairy, midlong to long (2 to 3 mm.).

Ludoviciana can be easily distinguished from the cultivated red oat by its larger, longer, and more hairy lemmas with long, strongly twisted and geniculate awns. (See figs. 28 and 29.) It is a transition form between the fully wild hairy *maxima* and *macrocarpa* very primitive varieties and the cultivated derivatives of *A. sterilis*, such as Red Algerian, Red Rustproof, and Fulghum, which belong to *A. byzantina*. Ludoviciana is a variable variety of the wild red oat.

History.—Ludoviciana (C. I. 1791) appears to have been first described in 1845 by Durieu (*4*), a French botanist, who apparently collected or obtained this wild oat material from the Mediterranean region of Europe. Only a few lots of seed of Ludoviciana have been received by botanists and oat specialists in the United States. The oat here described apparently is the one (P. I. 19503) that was received by the United States Department of Agriculture from the Province of Isfahan, Iran (Persia), in 1906. The sample was forwarded by John Tyler, then United States Vice Consul General at Teheran.

Distribution.—None.

Maxima

Description.—Similar to Ludoviciana except for the following characters: Juvenile growth semiprostrate; glumes 38 to 46 mm. long; grains plump; first lem-

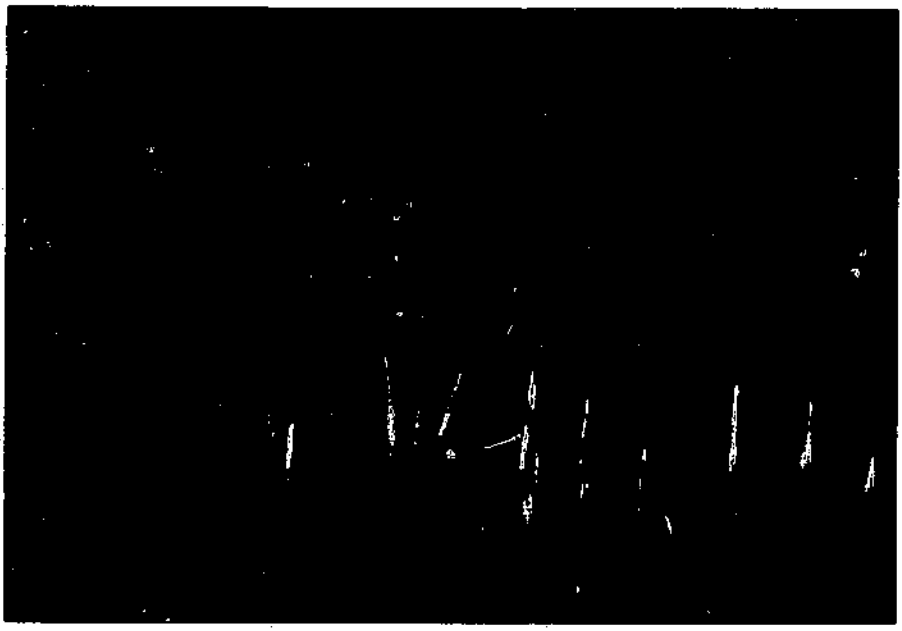


FIGURE 29.—Spikelets and florets of Ludoviciana. (× 1.)

mas extremely long (24 to 40 mm.), very hairy; awns 40 to 80 mm. long; caryopses 11 to 14 mm. long; second lemmas 18 to 30 mm. long, hairy; awns numerous, 40 to 70 mm. long.

Maxima differs from Ludoviciana in having awns on both the first and second lemmas of the spikelets (figs. 28 and 30). The glumes and lemmas are longer and the lemmas are covered with a dense growth of hairs. The awns also are longer, very stout, and twisted and geniculate. Because of these exceptional characters, Maxima is of taxonomic interest.

History.—Maxima (C. I. 2658) was first described by Perez Lara (*126*). The writer obtained specimens of this oat from the campus of the University of California, Berkeley, where it apparently was planted some years ago and has persisted to the present day.

Distribution.—None.

Macrocarpa

Description.—Similar to Maxima except for the following characters: Culms more decumbent at the base of the plants and hairy near the nodes. The awns are densely covered with short, fine hairs on the lower parts (fig. 31).

Macrocarpa is considered to be synonymous with *A. sterilis* var. *maxima* by Marquand (*107, pp. 34–35*). It is of much taxonomic and phylogenetic interest because of the extremely long lemmas, hairy awns, and other wild oat characters.

History.—Macrocarpa (C. I. 2657) also grows wild and was collected on the campus of the University of California at Berkeley.

Distribution.—None.

FIGURE 30.—Spikelets and florets of Maxima. (× 1.)

RED OAT

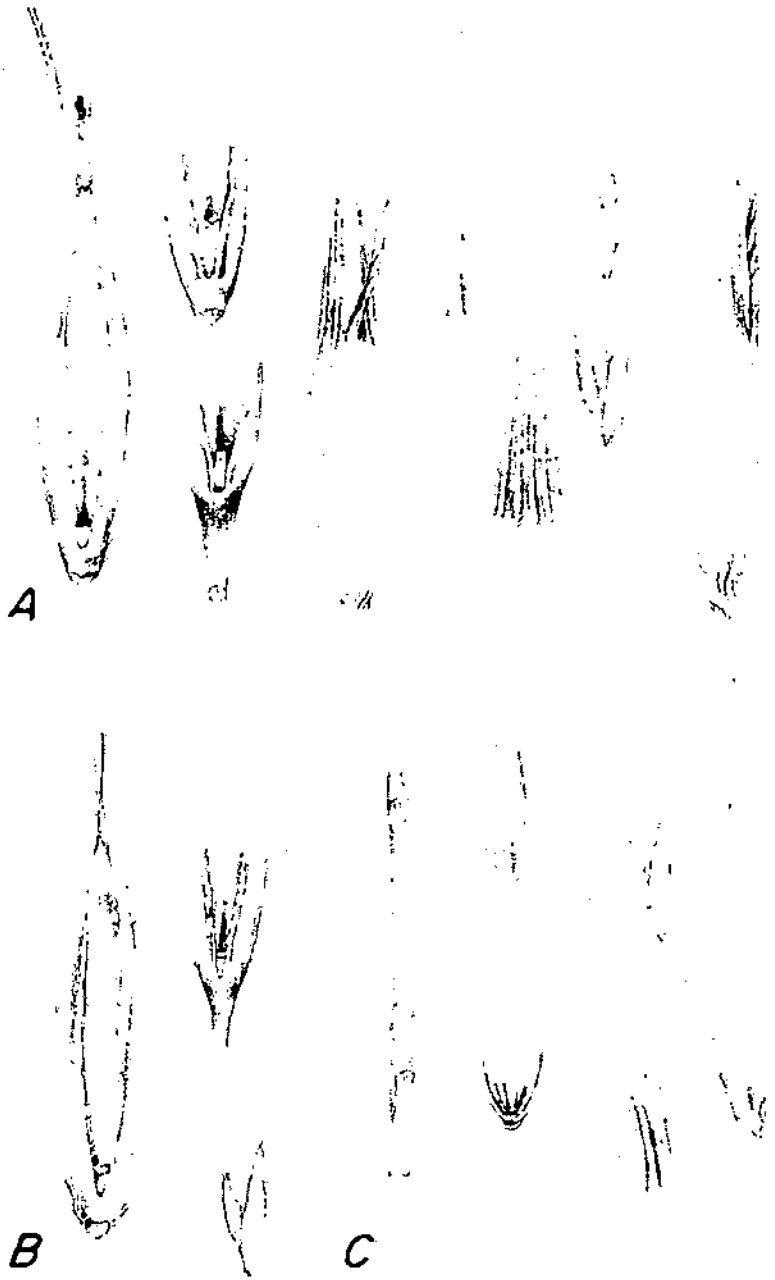


FIGURE 32.—Mode of floret separation in Fulghum (*A*) and Red Rustproof (*B*), the two leading varietal types of red oats, and Victory (*C*), a well-known varietal type of common oats, for comparison. (After Musil.)

longer and larger than in the common oat.

Certain varieties of red oats are grown from both fall and spring seeding in the southern half of the United States and in California. In these sections, this type of oat is grown almost exclusively. It has not been determined whether their successful culture in these warmer environments is caused by heat resistance or by disease resistance. In very recent years, however, the control of crown rust has increased yield, thus indicating that disease may be the chief limiting factor in oat production in the South.

A total of 50 varieties of red oats is described. Of these, 28 have been grouped in the key as representing true *sterilis* types, with second florets separating rather consistently by basifracture, and 22 as intermediate types, with second florets not separating consistently—by basifracture, heterofracture (intermediate), or disarticulation. Varieties derived from hybrids between red and common oats sometimes are difficult to classify. The varieties Burt (*37*) and Fulghum (*153*, *167*) are exceedingly variable and may have originated through natural hybridization between red and common oats.

A key to the varieties of red oats follows:

KEY TO THE VARIETIES OF RED OATS

		Page
1a. Second florets separating consistently by basifracture (true *sterilis*).		
2a. *Lemmas black.*		
3a. Lemmas black.		
First and second lemmas awns numerous, nontwisted.		
First lemmas long to very long (20 to 26 mm.).		
Spikelets separating by abscission (distinct suckermouths).		
Juvenile growth semiprostrate.		
Plants late, short to midtall (70 to 120 cm.).		
Grains midplump to plump	BLACK ALGERIAN	66
Juvenile growth prostrate to semiprostrate.		
Plants extremely late, midtall to tall (90 to 140 cm.).		
Grains plump	COASTBLACK	67
3b. Lemmas brown or brownish-black.		
Juvenile growth semiprostrate to erect.		
Plants early to midseason.		
Plants short to midtall (70 to 105 cm.).		
Spikelets separating by abscission (distinct suckermouths).		
First lemmas short to midlong (14 to 17 mm.).		
First lemmas awns numerous, nontwisted.		
Second lemmas awns absent.		
Grains midplump	FULMER	68
Plants midseason.		
Plants short to midtall (70 to 120 cm.).		
Spikelets separating by semiabscission or fracture.		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns common, nontwisted to twisted and subgeniculate.		
Second lemmas awns absent.		
Grains slender to midplump	CASSEL	68

KEY TO THE VARIETIES OF RED OATS—Continued

1a. **Second florets separating consistently by basifracture (true *sterilis*)—Continued**

2b. *Lemmas red.*

3a. Plants very early.
Juvenile growth semiprostrate to erect.
Plants very short to midtall (65 to 110 cm.).
Lemmas red.
First lemmas midlong (16 to 18 mm.).
First lemmas awns few or absent.
Second lemmas awns absent.
Grains plump

FULGRAIN	69
FULGRAIN STRAIN 4	70

3b. Plants early.
Juvenile growth erect.
Plants very short to short (50 to 75 cm.).
Lemmas red to brownish-red.
First lemmas long to very long (19 to 26 mm.).
First lemmas awns numerous.
Second lemmas awns few or absent.
Grains midplump to plump

CALCUTTA	70

Plants midtall (90 to 110 cm.).
Lemmas red.
First lemmas midlong to long (16 to 20 mm.).
First lemmas awns numerous.
Second lemmas awns common to numerous, nontwisted.
Grains slender to midplump

EARLY RED RUSTPROOF	71
VERDE	72

3c. Plants early to midseason.
Lemmas grayish-red (striped).
Juvenile growth semiprostrate to erect.
First lemmas short to midlong (14 to 16 mm.).
First lemmas awns common.
Second lemmas awns usually absent.
Plants short (60 to 85 cm.).
Grains midplump

FULTEX	72

3d. Plants midseason to late.
Juvenile growth prostrate to semiprostrate.
Plants short to midtall (60 to 100 cm.).
Lemmas red.
First lemmas long to very long (20 to 24 mm.).
First lemmas awns numerous.
Basal hairs numerous.
Second lemmas awns common to numerous, nontwisted.
Grains plump

RED RUSTPROOF	73
CAROLINA RED	75
NORTEX	75
RANGER	76
RANGLER	76
RUSTLER	76

Juvenile growth erect.
Plants short to midtall (70 to 110 cm.).
Lemmas red to grayish-red.
First lemmas short to midlong (14 to 17 mm.).
First lemmas awns numerous, nontwisted.
Second lemmas awns few or absent.
Basal hairs usually numerous.
Grains plump

BOND	76
CAMELLIA	77

KEY TO THE VARIETIES OF RED OATS—Continued

		Page
1a. Second florets separating consistently by basifracture (true *sterilis*)—Continued		
Juvenile growth semiprostrate to erect.		
Plants midtall to tall (90 to 140 cm.).		
Lemmas grayish-red.		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns numerous, twisted and subgeniculate to geniculate.		
Second lemmas awns absent.		
Basal hairs few or absent.		
Grains slender to midplump	BELAR	77
3c. Plants late.		
Juvenile growth semiprostrate to erect.		
Plants short to midtall (70 to 115 cm.).		
Lemmas red.		
First lemmas long to very long (22 to 26 mm.).		
First lemmas awns numerous.		
Second lemmas awns numerous.		
Grains midplump to plump	RED ALGERIAN	78
	ALBER	79
	BERGER	79
	LANDHAFER	79
2c. *Lemmas yellow.*		
3a. Plants very glaucous (purplish bloom) at time of full heading.		
Spikelets many 3-flowered, some 4-flowered.		
Lemmas reddish-yellow.		
First lemmas midlong (16 to 18 mm.).		
Plants early to midseason.		
Plants short (60 to 90 cm.).		
Second floret rachilla segments short (0.5 to 1.5 mm.).		
First lemmas awns few or absent (rare).		
Grains plump	NAVARRO	80
3b. Plants only slightly glaucous at time of full heading.		
Spikelets 2- to 3-flowered.		
Lemmas yellow.		
First lemmas midlong to long (16 to 20 mm.).		
Plants midseason to late.		
Plants midtall (90 to 115 cm.).		
Second floret rachilla segments very short (0.5 to 1.0 mm.).		
First lemmas awns few or absent.		
Grains plump	SEGETAL	81
Plants very late.		
Plants midtall to tall (90 to 140 cm.).		
Second floret rachilla segments midlong (1.5 to 2.0 mm.).		
First lemmas awns numerous.		
Grains midplump	TRISPERMA	81
2d. *Lemmas gray.*		
3a. Panicles midsized, usually erect.		
Juvenile growth prostrate.		
Plants midseason to late.		
Plants short to midtall (70 to 110 cm.).		
Second floret rachilla segments long (2.5 to 3.0 mm.).		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns numerous.		
Grains slender to midplump	CURRED	82

KEY TO THE VARIETIES OF RED OATS—Continued

		Page
1a. Second florets separating consistently by basifracture (true *sterilis*)—Continued		
3b. Panicles very large, drooping. Juvenile growth semiprostrate. Plants early to midseason. Plants tall (90 to 140 cm.). Second floret rachilla segments midlong (1.5 to 2.0 mm.). First lemmas short to midlong (14 to 17 mm.). First lemmas awns few or absent. Grains slender	AWNLESS CULRED	83
1b. Second florets not separating consistently by basifracture, heterofracture (intermediate), or disarticulation.		
2a. *Lemmas red.*		
3a. Plants very early. Juvenile growth erect. Plants midtall to tall (90 to 130 cm.). Culms small to midsized. Florets separating by basifracture, heterofracture, or disarticulation. Lemmas red to grayish-red (variable). First lemmas midlong to very long (18 to 24 mm.). First lemmas awns few to numerous, nontwisted to twisted and geniculate. Second lemmas awns few to common. Grains very slender	BUKT	83
	OTOE	84
Plants short to midtall (70 to 110 cm.). Culms small. Florets usually separating by disarticulation. Lemmas red. First lemmas midlong to long (16 to 20 mm.). First lemmas awns few or absent. Second lemmas awns absent. Grains slender	BRUNKER	84
Plants short (60 to 90 cm.). Culms small to midsized. Florets separating by disarticulation or basifracture. Lemmas red to yellowish-red. First lemmas short to midlong (14 to 17 mm.). First lemmas awns few to common, nontwisted to twisted and subgeniculate. Second lemmas awns absent. Grains midplump to plump	NEOSHO	85
3b. Plants early. Juvenile growth semiprostrate to erect. Florets separating by disarticulation or basifracture.		

KEY TO THE VARIETIES OF RED OATS—Continued

		Page
1b. Second florets not separating consistently by basifracture, heterofracture (intermediate), or disarticulation—Continued		
Plants short to midtall (70 to 110 cm.). Culms small to midsized. Lemmas red to grayish-red (buff). First lemmas midlong to long (16 to 20 mm.). First lemmas awns common. Grains slender to midplump	FULGHUM	85
	FRAZIER	87
	KANOTA	87
	KARREELA	87
	QUINCY RED	88
Plants midtall to tall (90 to 140 cm.). Culms midsized. Lemmas red. First lemmas short to midlong (14 to 18 mm.). First lemmas awns few or absent. Grains midplump to plump	FRANKLIN	88
3c. Plants midseason. Juvenile growth prostrate to semiprostrate. Plants midtall to tall (90 to 140 cm.). Culms midsized. Florets separating by disarticulation. Lemmas red to grayish-red (buff). First lemmas midlong to long (17 to 21 mm.). First lemmas awns few or absent. Grains midplump	FULWIN	88
	FORKEDEER	89
	PENTAGON	89
	TENNEX	89
	WINTER FULGHUM	89
3d. Plants late to very late. Juvenile growth semiprostrate to erect. Plants short to midtall (60 to 100 cm.). Culms small to midsized. Florets separating by disarticulation. Lemmas red to grayish-red. First lemmas long to very long (19 to 22 mm.). First lemmas awns numerous, twisted and geniculate. Grains slender to midplump	VICTORIA	89
2b. *Lemmas gray.* 3a. Plants very early. Plants midtall (90 to 120 cm.). Juvenile growth erect. Florets separating by disarticulation. Culms small to midsized, slightly hairy at the nodes. Lemmas gray to reddish-yellow. First lemmas midlong to very long (17 to 22 mm.). First lemmas awns common, nontwisted to twisted and subgeniculate. Grains slender to midplump	FULTON	90
	WESTDALE	91

KEY TO THE VARIETIES OF RED OATS—Continued

		Page
1b. Second florets not separating consistently by basifracture, heterofracture (intermediate), or disarticulation—Continued		
Culms small to midsized, usually glabrous at the nodes.		
Lemmas gray to brownish-gray (striped).		
First lemmas midlong to long (16 to 19 mm.).		
First lemmas awns few to common, nontwisted to twisted and subgeniculate.		
Grains slender	COLUMBIA	91
3b. Plants early.		
Plants short to midtall (60 to 100 cm.).		
Juvenile growth semiprostrate to erect.		
Florets separating by disarticulation.		
Culms midsized, glabrous at the nodes.		
Lemmas whitish-gray.		
First lemmas short to midlong (14 to 18 mm.).		
First lemmas awns few or absent.		
grains plump	VICTORGRAIN	92
3c. Plants early to midseason.		
Plants short to midtall (70 to 110 cm.).		
Juvenile growth erect.		
Culms small to midsized, very hairy at the nodes.		
Florets separating by disarticulation or basifracture.		
Lemmas gray.		
First lemmas midlong to long (17 to 20 mm.).		
First lemmas awns numerous, nontwisted to twisted and geniculate.		
Grains slender to midplump	RUAKURA	93
3d. Plants midseason.		
Plants midtall to tall (90 to 140 cm.).		
Culms small to midsized, slightly hairy at the nodes.		
Florets separating by disarticulation or basifracture.		
Lemmas brownish-gray.		
First lemmas midlong to long (16 to 19 mm.).		
First lemmas awns few or absent.		
Grains slender	SUNRISE	94

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONOMY OF THE RED OAT VARIETIES

Black Algerian

Description.—Juvenile growth semiprostrate; plants late, short to midtall (70 to 120 cm.); culms small to midsized, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small to midsized, straight, usually fully exserted; panicles equilateral, usually erect, small, short to midlong, midbroad, ovate; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, usually ascending, scabrous; spikelets usually few, 2- to 3-flowered, separating from pedicels by abscission leaving distinct basal scars (suckermouths); florets separating by basifracture; glumes 26 to 34 mm. long, 7 to 9 mm. wide, usually 9-veined, light-green, and somewhat glaucous before maturity; grains midplump to plump; lemmas black; first lemmas long to very long (20 to 26 mm.), glabrous; basal hairs numerous, long; awns numerous, nontwisted, 15 to 40 mm. long; caryopses 9 to 11 mm. long; second lemmas 14 to 18

mm. long; awns numerous, nontwisted 15 to 30 mm. long; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous or sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 33.

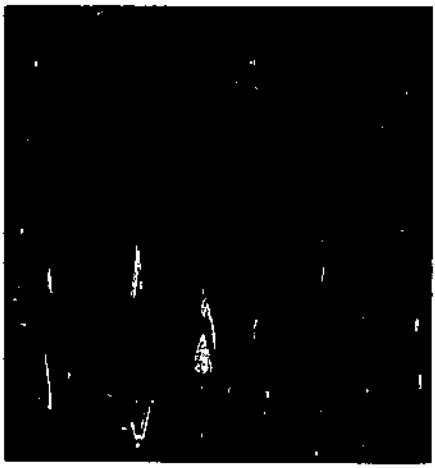


FIGURE 33.—Spikelets and florets of Black Algerian. (× 1.)

Black Algerian is differentiated mainly from Coastblack in not being so late in maturity and is also usually less vigorous and produces slightly shorter culms. Black Algerian is poorly adapted to conditions in the South and in California. Its color also is undesirable. Like Coastblack, Black Algerian lacks winter hardiness and is an intermediate to spring-type oat.

History.—Black Algerian (C. I. 3215) probably was first introduced officially into the United States from Algeria, Africa, as a mechanical mixture in samples of Red Algerian oats. Several such samples of the variety (P. I. Nos. 10263, 12133, and 46565) (*197*) have been received since 1903 by the United States Department of Agriculture for experimental purposes from the late noted botanist and authority on red oats of Algeria, L. Trabut. Etheridge (*61, pp. 127–128*) described an oat accessioned as P. I. No. 12133 under the name of "*Avena sterilis nigra.*"

Distribution.—Grown to a very limited extent.

Synonym.—*Avena sterilis nigra.*

Coastblack

Description.—Juvenile growth prostrate to semiprostrate; plants extremely late, midtall to tall (90 to 140 cm.); culms small to midsized, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small to midsized, straight, usually fully exserted; panicles equilateral, usually erect, small, short to midlong, midbroad, ovate; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, usually ascending, scabrous; spikelets usually few, 2- to 3-flowered, separating from pedicels by abscission leaving distinct basal scars (suckermouths); florets separating by basifracture; glumes 26 to 34 mm. long, 7 to 9 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains plump; lemmas black; first lemmas long to very long (20 to 26 mm.), glabrous; basal hairs numerous, long; awns numerous, nontwisted, 15 to 40 mm. long; caryopses 9 to 11 mm. long; second lemmas 14 to 18 mm. long; awns numerous, nontwisted, 15 to 30 mm. long; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous or sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 34.

Coastblack is a black oat, but otherwise it is morphologically similar to the red oat types, Red Rustproof and Red Algerian, described below. It usually is easily recognized by its long to very long black lemmas, weak or nontwisted awns on the first and second florets of the spikelets, and extremely late maturity. Although rather prostrate in early growth, it lacks winter hardiness and thus represents an intermediate to spring variety. Coastblack from spring seeding frequently fails to head and produce seed. From fall seeding at the

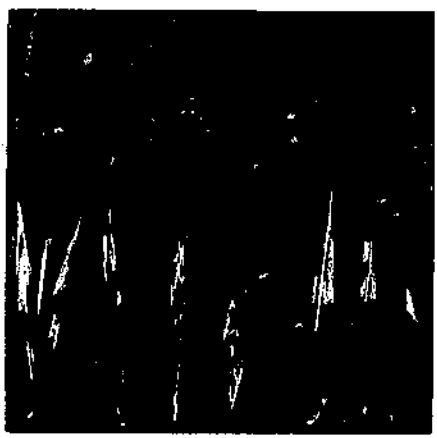


FIGURE 34.—Spikelets and florets of Coastblack. (× 1.)

Arlington Farm, Rosslyn, Va., it ripened prematurely; that is, before the grain was fully developed because of the advent of hot weather. Owing to its late maturity and tenderness when fall sown, Coastblack appears to be best adapted to the mild, cool, moist, climate of the coastal section of central California, where it grows vigorously, develops fully, and is rather productive.

History.—Coastblack (C. I. 3025) probably was introduced into California from northern Africa or other Mediterranean region as a mechanical mixture in seed of Red Algerian oats. However, it may have found its way into the Pacific coast region from Mexico through the early Spanish missions and has persisted until today. Coastblack was reported as an unnamed variety in the oat varietal survey of 1919, but samples of seed of the variety were obtained from California seedsmen prior to that year. Owing to the special adaptation of this oat to the central coastal section of California, the name "Coastblack" was applied to it by the late George W. Hendry of the College of Agriculture, University of California, Berkeley, in 1922.

Distribution.—Grown to a limited extent in the central coastal section of California, particularly in San Mateo County and nearby counties, and also to even a more limited extent in the coastal section of Oregon.

Synonyms.—California Black, Commercial Black. These names are applied to commercial strains of Coastblack in the central coastal section of California.

Fulmer

Description.—Juvenile growth semiprostrate to erect; plants early to midseason, short to midtall (70 to 105 cm.); culms small to midsized, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small, straight, usually fully exserted; panicles equilateral, usually erect, small to midsized, short, midbroad, ovate; rachises slightly flexuous, nodes 5 to 7; branches short to midlong, usually spreading, scabrous; spikelets few to numerous, 2- to 3-flowered, separating from pedicels by abscission, leaving small basal scars (distinct suckermouths); florets separating by basifracture; glumes 20 to 26 mm. long, 6 to 8 mm. wide, 8- to 9-veined, light-green and glaucous before maturity; grains midplump; lemmas brown or brownish-black; first lemmas short to midlong (14 to 17 mm.), sparsely hairy laterally; basal hairs numerous, midlong; awns numerous, nontwisted, 10 to 25 mm. long; caryopses 7 to 9 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous or sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 35.

FIGURE 35.—Spikelets and florets of Fulmer. (× 1.)

Fulmer, a more stable variety of spring oats than Cassel, is distinct from Cassel in having slightly shorter lemmas and a spikelet separation that occurs rather consistently by abscission, resulting in small but well marked basal cavities. The awn is of the weak, or nontwisted, type, and there are numerous basal hairs. Like Cassel the lemmas are sparsely hairy laterally. Fulmer usually has slightly shorter culms and under most conditions is a little earlier in maturity. Fulmer may be of value for developing Red Rustproof type varieties with shorter glumes and lemmas.

History.—Fulmer (C. I. 3216) was selected from Cassel by the writer. It apparently resulted from a natural cross, but has continued to be homozygous for all observable characters.

Distribution.—Grown to a very limited extent.

Cassel

Description.—Juvenile growth semiprostrate to erect; plants midseason, short to midtall (70 to 120 cm.); culms small to midsized, fairly stiff, glabrous, or slightly hairy at the nodes; sheaths dark-green, glabrous; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small, straight, usually fully exserted; panicles equilateral, usually erect, small to midsized, short, midbroad, ovate; rachises usually slightly flexuous, nodes 5 to 7; branches short to

midlong, usually spreading, scabrous; spikelets few to numerous, 2- to 3-flowered, separating from pedicels by semiabscission or fracture; florets separating by basifracture; glumes 22 to 28 mm. long, 6 to 8 mm. wide, 8- to 9-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas brown or brownish-black; first lemmas midlong to long (16 to 20 mm.), glabrous, or sparsely hairy laterally; basal hairs few to several, midlong; awns common, usually dark-colored on lower parts, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 8 to 10 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments occasionally sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 36.

FIGURE 36.—Spikelets and florets of Cassel. (× 1½.)

Cassel, a spring variety, differs from Coastblack in being much earlier, in having brown or brownish-black rather than black lemmas, and usually having awnless second florets. The lemmas are shorter and more sparsely hairy laterally, the grains are more slender, and the awns on the first floret are of the nontwisted to twisted and subgeniculate type. Cassel is a slightly variable variety and is of taxonomic interest.

History.—Cassel (C. I. 2911) was originated and first described by Etheridge (*61, p. 139*) under the name "Sterilis Selection" (C. I. 1859). He, in the course of his classification studies, selected it from a commercial strain of the Red Rustproof variety.

Distribution.—Grown to a very limited extent.

Synonyms.—Sterilis Selection, Sterisel.

Sterisel (C. I. 2891) is a strain of the variety used as a differential host for the identification of certain physiologic races of stem rust of oats by cereal pathologists who selected and named it. Under some conditions it is a little earlier than Cassel and the lemmas in some seasons are lighter brown.

Fulgrain

Description.—Juvenile growth semiprostrate to erect; plants very early, short to midtall (65 to 110 cm.); culms small to midsized, stiff, occasionally slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins usually ciliate on lower third; peduncles midsized, straight, fully exserted; panicles equilateral, erect, small, short to midlong, narrow, ovate; rachises usually slightly flexuous, nodes 4 to 6; branches short, ascending or drooping, scabrous; spikelets usually few, 2- to 3-flowered, separating from pedicels by semiabscission or fracture; florets separating by basifracture; glumes 24 to 30 mm. long, 7 to 9 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains plump; lemmas red; first lemmas midlong (15 to 18 mm.), glabrous; basal hairs few to several, midlong; awns few or absent; caryopses 8 to 10 mm. long; second lemmas 10 to 15 mm. long; awns absent; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 37.

FIGURE 37.—Spikelets and florets of Fulgrain. (× 1.)

Fulgrain, a winter- to semiwinter-type red oat, differs from Fulghum in being a week earlier and in having plumper grains. The second floret rachilla segments separate from the lower florets rather consistently by basifracture (adherent) as is the case in typical varieties of *A. byzantina*. Thus, floret separation of Fulgrain is more representative of the type species than is Fulghum. Fulgrain is resistant to the Fulghum races of the oat smuts and is more winter resistant than the Navarro parent.

History.—Fulgrain (C. I. 3253, Coker No. 33-19) (*40*) was selected in 1925 from a cross between Big Boy (Norton No. 20-93), an unnamed type, and Navarro by the late George J. Wilds of the Coker's Pedigreed Seed Co., Hartsville, S. C. It was first sold to farmers in 1936 (*156, p. 387*).

The original Fulgrain oat was formerly grown in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Following the release in the fall of 1940 of Fulgrain Strain 4 with resistance to crown rust, the old strain is now grown to a very limited extent in only a few of these States.

Distribution.—Grown to a very limited extent.

Synonyms.—Fulgrain Strain 2, Fulgrain Strain 3, Marett Winter Resistant.

Fulgrain Strain 2 (C. I. 3423) and Fulgrain Strain 3 (C. I. 3697), further reselection of the original Fulgrain oat, were first distributed in 1937 and 1938, respectively, by the Coker's Pedigreed Seed Co.

Marett Winter Resistant (C. I. 3920) (*106, 1944*) is a strain of the Fulgrain type which has been distributed for a number of years by the Marett Farm & Seed Co., of Westminster, S. C. It originated as a selection from Fulgrain and is now grown to some extent in western South Carolina.

Fulgrain Strain 4

Description.—Fulgrain Strain 4 is similar to Fulgrain in nearly all plant and grain characters, although a less vigorous oat. As previously indicated, Fulgrain Strain 4 differs from Fulgrain in having resistance to many races of crown rust. It also is resistant to most races of the oat smuts, but it is susceptible to Victoria blight.

History.—Fulgrain Strain 4 (C. I. 3833, Coker 39–2) was developed from a cross between the original Fulgrain, previously described, and Victoria by the late G. J. Wilds and coworkers of the Coker's Pedigreed Seed Co., Hartsville, S. C. In the new selections the plant and grain characters of Fulgrain were almost completely recovered and combined with genes for crown rust resistance from the Victoria parent. Fulgrain Strain 4 was first distributed to farmers of the South in the fall of 1940 (*40*).

Distribution.—Grown in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Synonyms: Fulgrain Strain 5, Fulgrain Strain 6, Fulgrain Strain 7.

Fulgrain Strains 5 (C. I. 4103), 6 (C. I. 4205), and 7 (C. I. 4389) were further releases from the cross between Fulgrain and Victoria of the Fulgrain type. To avoid increasing strain numbers, unnumbered strains were released and designated such as Fulgrain 1946 Breeder Foundation Stock and Fulgrain 1947 Breeder Foundation Stock (*40, 1942–47*).

Calcutta

Description.—Juvenile growth erect; plants early, very short to short (50 to 75 cm.); culms small, fairly stiff, hairy at the nodes; sheaths dark-green, usually slightly hairy; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small, straight, usually fully exserted; panicles equilateral, erect or slightly drooping, small, short, narrow, ovate; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, ascending or spreading, scabrous; spikelets usually few, usually 2-flowered, separating from pedicels by abscission and leaving large, distinct basal scars (suckermouths); florets separating by basifracture; glumes 26 to 32 mm. long, 7 to 9 mm. wide, 7- to 9-veined, light-green and glaucous before maturity; grains midplump to plump; lemmas red to brownish-red; first lemmas long to very long (19 to 26 mm.), glabrous; basal hairs numerous, long; awns numerous, slightly dark-colored on lower parts, nontwisted, 25 to 37 mm. long; caryopses 9 to 11 mm. long; second lemmas 14 to 16 mm. long; awns few or absent; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 38.

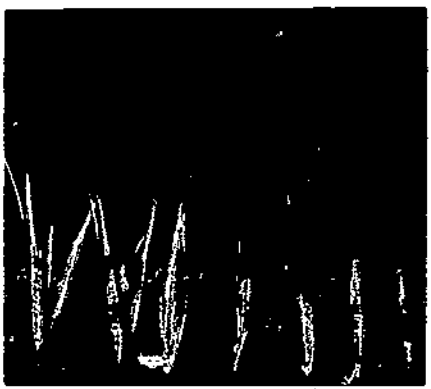


FIGURE 38.—Spikelets and florets of Calcutta. (× 1.)

Calcutta is an early spring red oat with very short, small culms. It differs from Red Rustproof (see p. 73) in having few or no awns on the second florets, in having longer, red to brownish-red lemmas, and in being earlier in maturity. These characters definitely separate Cal-

cutta from the Early Red Rustproof and Red Rustproof varieties.

History.—Calcutta (C. I. 794) came originally from Calcutta, India, from whence it was introduced into Algeria and other Mediterranean countries. From Algeria, it was taken to Australia. The first recorded introduction into the United States was by the United States Department of Agriculture, on Nov. 12, 1906, when a small quantity of seed was received from Hugh Pye, Dookie, Victoria, Australia (*197*). Additional experimental lots (P. I. Nos. 42091, 48117, and 61305) were received later from the Agricultural Division of the Department of Agriculture, Melbourne, Victoria, Australia. Calcutta is of some economic importance in Algeria, India, and Australia where very early, short-strawed strains of red oats are in demand.

Distribution.—Grown to a very limited extent.

Synonyms.—Brown Calcutta, Cape, Indian, Palestine.

Indian (C. I. 2154) is a sample of Calcutta that was received from Wilber Kohlinger, American Consul, Bombay, India, in 1925. Palestine was received from the Agricultural Division of the Department of Agriculture, Melbourne, Victoria, Australia, on August 5, 1926. The record accompanying the seed showed that it was developed at the State Research Farm, Werribee, Victoria, from a single plant selected by G. S. Gordon from a plot sown with a very mixed sample of seed introduced from Palestine. It resembles Algerian [Red Algerian] in type of panicle and grain, but the straw is shorter and the plants ripen earlier.

The mass population from which Gordon made the selection was collected in Palestine during World War I by T. Cherry while on military duty.

Archer (*6, p. 26*) and Pridham (*120, p. 350*) named Brown Calcutta and Cape as additional synonymous strains of Calcutta. Apparently the name "Brown Calcutta" had been applied because of the brownish-red grains of the Calcutta variety. All the oats labeled "Cape" that have come to the writer's attention have been typical not of Calcutta but of Red Algerian. Because of drought resistance, seed of Palestine (C. I. 2328) has been distributed in limited quantities for growing in certain sections of California by the State agricultural experiment station at Davis.

Early Red Rustproof

Description.—Juvenile growth erect; plants early, midtall (90 to 110 cm.); culms small, fairly stiff, glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins occasionally ciliate on lower third; peduncles small, straight, fully exserted; panicles equilateral, erect or slightly drooping, small, short, narrow to midbroad, ovate; rachises usually slightly flexuous, nodes 4 to 6; branches short to midlong, ascending or drooping, scabrous; spikelets usually few, usually 2-flowered, separating from pedicels by abscission, leaving distinct basal scars (suckermouths); florets separating by basifracture; glumes 22 to 30 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas red; first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs numerous, short; awns numerous, nontwisted, 15 to 25 mm. long; caryopses 8 to 11 mm. long; second lemmas 12 to 15 mm. long; awns common to numerous, nontwisted, 10 to 20 mm. long; caryopses 6 to 9 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 30.

FIGURE 30.—Spikelets and florets of Early Red Rustproof. (× 1.)

Early Red Rustproof differs from Red Rustproof mainly in being erect in early growth habit, decidedly earlier, and is distinctly a spring oat. It also grows taller and has slightly shorter lemmas and more slender grains than Red Rustproof.

History.—Early Red Rustproof (C. I. 2823, Kans. No. 5213–7) was developed by John H. Parker of the Kansas Agricultural Experiment Station, Manhattan, in cooperation with the United States Department of Agriculture. According to Dr. Parker,* the parental stock of seed from which this selection was made was received from T. A. Kiesselbach, of the

*Letter from J. H. Parker to T. R. Stanton, dated December 29, 1937.

Nebraska station, in March 1918. Panicle selections were made in June 1918 and grown in panicle rows in 1919. The panicle selection, No. 7, appeared promising and was advanced to rod rows and was grown for several years. Finally in 1936, in spite of its good yield record, it was not increased because of its rather undesirable lemma characters such as large basal scars and numerous non-twisted awns.

Distribution.—Grown to a limited extent.

Synonym.—Early Red Texas.

Early Red Texas (C. I. 3674) is a mass stock of Early Red Rustproof that has been grown by the Nebraska Agricultural Experiment Station and on a few Nebraska farms.

Verde

Description.—Verde, an intermediate to spring red oat, differs somewhat from Early Red Rustproof in ripening 4 to 6 days later and in having a shorter straw and slightly more slender grains that shatter rather quickly. It is resistant to many races of the rusts and smuts of oats that are found in Texas, but it is susceptible to Victoria blight. It lacks winter resistance and hence was not recommended for fall seeding north of the Edwards Plateau of Texas. Owing to its susceptibility to Victoria blight, low yield, and tendency to shatter, Verde has not attained much economic importance. It was the first strain of oats similar to Red Rustproof that was developed with resistance to certain races of both crown rust and stem rust.

History.—Verde (C. I. 4312) originated from a cross between a strain of Red Rustproof and an unnamed Victoria-Richland selection (No. 5542-1), the first generation of which was backcrossed to the Red Rustproof parent. The cross was made at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, by F. A. Coffman in 1934. The selection giving rise to Verde was made by E. S. McFadden in the cooperative oat breeding experiments between the Texas Agricultural Experiment Station and the United States Department of Agriculture at College Station, Tex., from bulk hybrid material furnished by the Cereal Crops Section. Verde was first distributed to farmers of the lower Rio Grande Valley of Texas in 1945, primarily as a forage variety and also for clipping to produce dehydrated cereal food and feed products.

Distribution.—Grown to a very limited extent in southern Texas.

Fultex

Description.—Juvenile growth semiprostrate to erect; plants early to midseason, short (60 to 85 cm.); culms small, very stiff, usually glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small, straight, occasionally not fully exserted; panicles equilateral, erect, small, short, narrow, ovate; rachises usually slightly flexuous, nodes 4 to 6; branches short, ascending or spreading, scabrous; spikelets few, 2- to 3-flowered, separating from pedicels by semiabscission or fracture; florets separating by basifracture; glumes 20 to 25 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains midplump; lemmas grayish-red (striped); first lemmas short to midlong (14 to 16 mm.), glabrous; basal hairs few or absent; awns common, dark-colored on lower parts, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 9 to 11 mm. long; second lemmas 12 to 14 mm. long; awns usually absent; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous, short (1.0 to 1.5 mm.). Spikelets and florets are shown in figure 40.

FIGURE 40.—Spikelets and florets of Fultex. (× 1.)

Fultex is a fairly hardy winter oat and is differentiated by its short, very stiff straw with short grayish-red (striped) lemmas separating rather consistently by basifracture (fig. 42). It is resistant to many races of smut and crown rust. It is well suited for combining, because of its stiff straw and ability to stand in the field after ripening. It is susceptible to Victoria blight.

History.—Fultex (C. I. 3531) was selected from a cross (No. N3020) between Fulghum (C. I. 708) and Victoria made at Arlington Farm, Rossiyn, Va., in 1930 by F. A. Coffman. Bulk seed for the F_5 generation was sent to Texas Substation No. 6, Denton, in 1932. Fultex (Tex. No. 12-34-33) was selected, in 1933, by I. M. Atkins. It was subsequently tested and increased by I. M. Atkins and P. E. Dunkle, and distributed to farmers of north-central Texas in 1940. Fultex was

bred cooperatively by the Texas Agricultural Experiment Station and the United States Department of Agriculture. It is registered as an improved variety (*154*, p. *33*).

Distribution.—Grown in Arkansas, Mississippi, and Texas.

Red Rustproof

Description.—Juvenile growth prostrate to semiprostrate; plants midseason to late, short to midtall (60 to 100 cm.); culms small, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, hairy; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small, straight, fully exserted; panicles equilateral, erect or slightly drooping, small, short, narrow to midbroad, ovate; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, ascending or spreading, scabrous; spikelets usually few, 2-flowered or occasionally 3-flowered, separating from pedicels by abscission and leaving large, distinct basal scars (sucker-mouths); florets separating by basifracture; glumes 24 to 30 mm. long, 7 to 9 mm. wide, 7- to 9-veined, light-green and glaucous before maturity; grains plump; lemmas red; first lemmas long to very long (20 to 24 mm.), glabrous; basal hairs numerous, long; awns numerous, nontwisted, 10 to 30 mm. long; caryopses 8.5 to 10.5 mm. long; second lemmas 14 to 17 mm. long; awns common to numerous, nontwisted, 10 to 20 mm. long; caryopses 6.5 to 8.5 long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 41.

Red Rustproof, a semiwinter, or intermediate, type, differs primarily from Coastblack and Black Algerian in having reddish lemmas. It is easily recognized by its short, reddish, rather fine straw, small panicles, and large, plump grains with weak, or nontwisted, awns, many long basal hairs, and large basal scars. Both lemmas of the spikelet also usually bear awns. It is one of the most important and distinct types of red oats grown in the United States.

History.—Red Rustproof (C. I. 1079) apparently was introduced and first grown in the United States many years ago. No authentic records are available on its introduction into the Southern States or into California, where it may have been first grown. Red Rustproof probably originated as a selection from Red Algerian, a closely allied variety, that had been introduced into the Southern States directly from the Mediterranean region of Europe or from Mexico into California.

Hendry and Kelly (*74*) found both wild and cultivated red oat types in adobe bricks used in the walls of the Spanish mission San José de Guadalupe and Rancho Vallejo in California, erected about 1811 and 1834, respectively. These facts indicate that the Red Rustproof

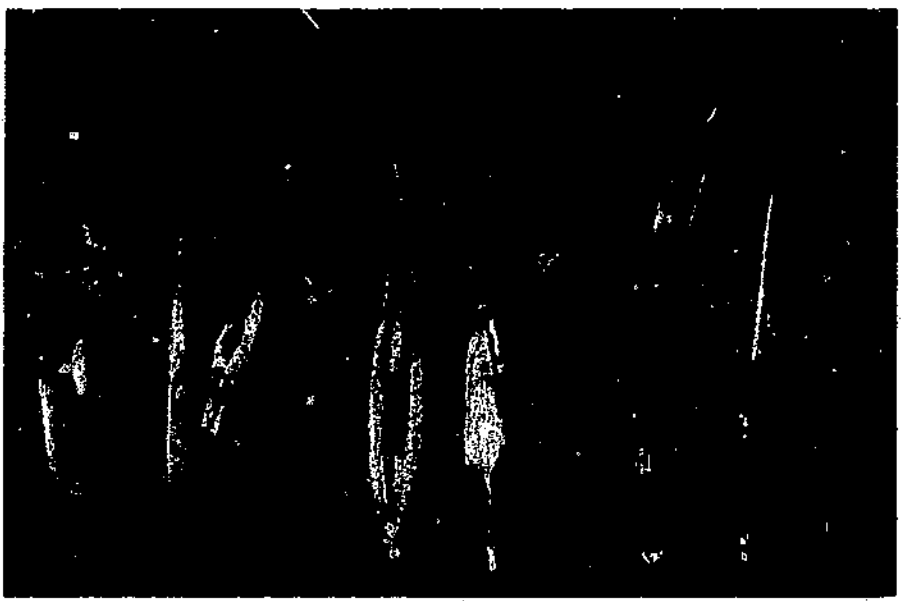


FIGURE 41.—Spikelets and florets of Red Rustproof. (× 1⅝.)

variety may have been grown in this country at a much earlier date than is indicated in other available records and that it came in from Mexico by way of the early Spanish missions of lower California.

References to "Rustproof" oats apparently began to appear in southern farm periodicals in the late sixties and early seventies of the last century, thus indicating that this type of oats probably was not known in the South until after 1865. One story (*211*) suggests that the variety started in the Southeastern States from volunteer plants found growing on the site of an old military camp in southwestern Georgia. Short items too numerous to cite here in agricultural journals issued prior to 1860, such as the Southern Cultivator, indicate that oats were exceedingly poorly adapted to the warm climate of the South and that rust was a serious limiting factor in their production. Furthermore, oats became a more certain crop with the advent of the Red Rustproof type that "resisted rust;" hence, the origin of the name "Rustproof." This is somewhat of a misnomer because Red Rustproof today is not actually resistant to either crown or stem rust. Rust develops later in the life of the plant than in other susceptible varieties, and, consequently, Red Rustproof partly escapes rust damage. Recently the term "late rusting" has been used to describe this quality of the Red Rustproof oat. However, all strains of the variety do not possess this character.

For many years Red Rustproof held an important place, especially for fall seeding, in California, Georgia, Alabama, Mississippi, Arkansas, Louisiana, and Texas; however, it was largely replaced for spring seeding during the decades of the 1920's and 1930's by strains of Fulghum, particularly Kanota, in Missouri, Kansas, Oklahoma, and California. In 1919, it was grown on about 6 million acres.

Distribution.—Grown in Alabama, Arizona, Arkansas, California, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, New Mexico, North Carolina, Ohio, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Synonyms.—Alabama Red Rustproof No. 43a, Appler, Bancroft, Baylis, California Red, Cliff, Cook, Dunnier, Delta Red No. 88, Ferguson No. 71, Ferguson No. 922, Hastings (Hastings Hundred Bushel or Hundred Bushel), McGehee, Mercier, New Nortex, Patterson Red Rustproof, Red Texas, Terruf, Texas Red (Red Texas).

Alabama Red Rustproof No. 43a (C. I. 3934) was selected by H. B. Tisdale, of the Alabama Agricultural Experiment Station, at Auburn, in 1930. It was first distributed about 1940 and replaced Alabama Red Rustproof No. 740, a closely related strain that was grown on approximately 50 percent of Alabama's oat acreage in 1935 (*156, p. 381*). For some unknown reason, Alabama Red Rustproof 43a never gained acceptance in Alabama or adjoining States.

Appler (C. I. 1815), a strain of Red Rustproof, was selected by J. E. Appler of Georgia. Originally it was a very uniform strain and was advertised as being hardier and better adapted to light soils than the unselected Red Rustproof. Appler was at one time one of the most widely grown of the improved strains of Red Rustproof.

Bancroft (C. I. 4468) was selected and distributed by R. M. Turner, who lived near Royston, Ga. Details regarding its development are not available. It apparently never attained the popularity of the Appler strain. Bancroft has been kept reasonably pure and is still standard in east-central Georgia.

Baylis (C. I. 854), a typical Red Rustproof strain, apparently originated as a selection from that variety in Mississippi on the farm of a man by the name of "Baylis." It has not attained much economic importance and is little known outside the State of Mississippi.

California Red (C. I. 3026) is the name usually applied to commercial stocks of Red Rustproof grown in California. However, some of these strains under certain conditions grow a little taller than the typical Red Rustproof oat.

Cliff (C. I. 518) was obtained from a Mr. Cliff of Franklin, Nebr., in 1906 by the United States Department of Agriculture. No information relative to its origin in that State is available. One of the best strains (Selection 518-3) ever developed of the Red Rustproof type was selected from Cliff by the late C. W. Warburton at Arlington Farm, Rosslyn, Va. Unfortunately this selection was not named and was distributed to experiment stations in the South simply as a selection of Red Rustproof. Its identity apparently was soon lost. There is a possibility, however, that Nortex, a similar oat discussed later, may have had its origin from this same Cliff strain. Former Director C. A. Mooers, of the Tennessee Agricultural Experiment Station, stated that Selection 518-3 was the best strain of the Red Rustproof type ever tested and grown in Tennessee.

The Cook (C. I. 697) strain was originated in Butler County, Ala., where, in 1915, it was reported to have been grown

continuously for more than 40 years without severe rust damage. No particulars regarding its ancestry are available, and the strain is now of little importance. Danier (C. I. 861) is a strain of Red Rustproof that is still infrequently found on farms of the South. Its origin has not been determined. Delta Red No. 88 (C. I. 4220) is a stiff-strawed strain of Red Rustproof that was selected by and recently distributed from the Delta Branch Station, Stoneville, Miss., particularly for growing in the delta section of that State.

Ferguson No. 71 (C. I. 1039) was selected in 1906 and released in 1916 by A. M. Ferguson, a pioneer commercial oat breeder, formerly of Sherman, now of Howe, Tex. It appeared to be the most promising of the selections of the Red Rustproof type growing in his nursery and later was increased and distributed. Ferguson No. 922 (C. I. 2150) was released by Ferguson about 10 years later as a further selection from Red Rustproof. It is now a leading commercial strain of Red Rustproof grown in Texas and other Southwestern States and has largely replaced Ferguson No. 71 (*156, p. 886*).

Hastings (Hastings Hundred Bushel or Hundred Bushel) (C. I. 3623) is a standard commercial stock of Red Rustproof that has been distributed extensively by the H. G. Hastings Seed Co., of Atlanta, Ga., since 1907. An unusually good stock of mass-selected Red Rustproof oats from a forgotten source was purchased by which Mr. Hastings applied the name "Hastings Hundred Bushel." It has been one of the most uniform of the more important commercial strains of Red Rustproof and is still grown to a very limited extent in Georgia and Alabama.

McGehee (C. I. 927) originated on the farm of J. Burrus McGehee and was grown by his son J. S. McGehee at Laurel Hill, La. Information regarding its selection is not available. It was one of the first of the improved strains of Red Rustproof that was bred especially for Louisiana conditions. Its distribution was confined mostly to Louisiana where it is now of little commercial importance.

Mercier (C. I. 7461) was developed by W. B. Mercier, who formerly lived near Centreville, Miss. (*136*). It is believed, however, that this strain was originally developed in the vicinity of Wilson, La., and afterwards taken into Mississippi by migrating farmers. Details regarding its improvement and distribution are undetermined. Mercier has been nearly, if not entirely, replaced by other strains of the Red Rustproof type or by other varieties.

New Nortex (C. I. 3422), a selection of the Appler strain of the Red Rustproof type, was developed and distributed from Texas Substation No. 6, Denton, in 1940. Under some conditions it ripens a little later and is slightly more productive than Nortex.

The Patterson Red Rustproof (C. I. 926) strain gets its name from J. F. Patterson, who selected and grew it on his farm 7 miles east of Baton Rouge, La., for many years (*146*). There is no record as to the source of the original stock from which the selection was made. It is now grown to a very limited extent.

Terruf (C. I. 3479) was developed and distributed about 1938, by the late R. P. Bledsoe of the Georgia Agricultural Experiment Station, Experiment. Its distribution has been limited mainly to central Georgia.

The names "Texas Red" and "Red Texas" (C. I. 953) probably are applied to the Red Rustproof type of oats more generally than any others. These names apparently were applied after the variety had become popular in Texas and seed of it was supplied to other Southern States, especially to those east of Texas.

Carolina Red

Description.—Carolina Red, a winter to semiwinter red oat, differs from Red Rustproof in having slightly more slender grains and better winter hardiness. It is resistant to the older races of crown rust and to many races of the oat smuts. Carolina Red is only moderately resistant, however, to the newer races of crown rust, such as races 45 and 57. It is susceptible to Victoria blight.

History.—Carolina Red (C. I. 4313) originated from a Nortex-Victoria cross (No. X3012) made at the Arlington Farm, Rosslyn, Va., by F. A. Coffman in 1930. Numerous selections from this cross were made and tested at Arlington Farm and cooperatively with the Georgia Coastal Plain Experiment Station at Tifton, Ga. A reselection (T. 63) made at Tifton was tested by the agricultural experiment station, at Experiment, Ga., and later by the Marett Farm & Seed Co., of Westminster, S. C., with favorable results. This company first distributed the variety under the name of "Carolina Red" in the fall of 1944.

Distribution.—Grown to some extent in western South Carolina.

Nortex

Description.—Nortex, a semiwinter oat, differs from the Red Rustproof variety in being more uniform in plant and grain characters, in ripening 1 to 3 days earlier, in having slightly stiffer straw, and in producing higher yields.

History.—Nortex (C. I. 2382) originated in 1914 as a pure-line selection from Red Rustproof oats obtained from a farmer at Krum, Tex., by the Texas Agricultural Experiment Station at Substation No. 6, Denton (*156, p. 386*). Nortex is registered as an improved variety (*171*) and was first distributed to farmers in 1926. It constitutes one of the most uniform and productive strains of the Red Rustproof type that has been developed.

Distribution.—Grown in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, and most extensively in Texas.

Ranger

Description.—Ranger, a semiwinter red oat, differs from most strains of Red Rustproof in being a little later and in having a little taller straw. It is resistant to the oat smuts and the older races of crown rust. It is only moderately resistant, however, to the newer races of crown rust such as races 45 and 57. Ranger is susceptible to Victoria blight.

History.—Ranger (C. I. 3417) (*35*) was selected from a cross (No. X3012) between Nortex and Victoria oats made by F. A. Coffman at Arlington Farm, Rosslyn, Va., in 1930. The early hybrid generations were grown at Aberdeen, Idaho, or in the greenhouse at Arlington Farm, Rosslyn, Va., and bulk seed from F$_2$ plants was sent to the Texas Agricultural Experiment Station, College Station, in the fall of 1933 by the Cereal Crops Section, United States Department of Agriculture. Plants resistant to crown rust and having a winter growth habit were selected by P. C. Mangelsdorf in 1934. Testing of the selections continued by P. C. Mangelsdorf, I. M. Atkins, and E. S. McFadden at College Station and Denton, Tex., permitted an elimination of susceptible progenies. The outstanding productiveness of Tex. M39–17 (C. I. 3417) was apparent by 1936. It was named Ranger in 1940 and registered as an improved variety (*171, p. 33*). Ranger was first distributed in southern Texas in the fall of 1941.

Distribution.—Grown to some extent in southern Texas.

Rangler

Description.—Rangler, a winter to semiwinter type red oat, differs from Red Rustproof in maturing later, in growing a little taller, and in being more winterhardy. Rangler is resistant to the older races of crown rust but only moderately resistant to the newer races and is susceptible to Victoria blight. It has resistance to most races of the oat smuts.

History.—Rangler (C. I. 3733) (*35*) was selected from the same cross as Ranger by F. A. Coffman at Arlington Farm, Rosslyn, Va., in 1938. In 1939 it was grown in the greenhouse and in the nursery at the same station.

Distribution.—Grown to a very limited extent.

Rustler

Description.—Rustler, a semiwinter red oat, differs from Red Rustproof in maturing 3 to 5 days earlier. Under most conditions the plants are noticeably shorter than those of Nortex or other typical Red Rustproof strains. Also fewer of the second lemmas of the spikelets of Rustler are awned. Rustler is resistant to most of the older races of crown rust but only moderately resistant to the newer ones. It is susceptible to Victoria blight but resistant to most races of the oat smuts that occur in Texas.

History.—Rustler (C. I. 3754) (*35*) is a sib of Ranger and, hence, has the same history. It was developed simultaneously with Ranger by the Texas Agricultural Experiment Station and the United States Department of Agriculture. Rustler was first distributed at the same time as Ranger in 1941 by the Texas Agricultural Experiment Station. It is registered as an improved variety (*171, p. 33*).

Distribution.—Grown to a limited extent in southern Texas.

Rond

Description.—Juvenile growth erect; plants midseason to late, short to midtall (70 to 110 cm.); culms midsized to large, very stiff, slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins glabrous or slightly ciliate on lower third; peduncles small to midsized, straight, fully exserted; panicles equilateral, erect, small, midlong, midbroad, ovate; rachises very flexuous, nodes 4 to 5; branches short, ascending or spreading, scabrous; spikelets usually few, 2- to 3-flowered, separating from pedicels by abscission and leaving distinct basal scars (suckermouths); florets separating by basifracture; glumes 20 to 25 mm. long, 6 to 8 mm. wide, 7- to 9-veined, light-green and glaucous before maturity; grains plump; lemmas red to grayish-red; first lemmas short to midlong (14 to 17 mm.), glabrous; pulleas occasionally brownish; basal hairs numerous, short; awns numerous, nou-

twisted, 20 to 25 mm. long; caryopses 7.5 to 9.5 mm. long; second lemmas 10 to 14 mm. long; awns few or absent: caryopses 6 to 8 mm. long; second floret rachilla segments glabrous or sparsely hairy, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 42.

FIGURE 42.—Spikelets and florets of Bond. (× ⅝.)

Bond is a distinct variety more or less intermediate in certain morphological characters between Golden Rain and Red Algerian. The spikelets separate from their pedicels by abscission, leaving distinct basal cavities, and the second lemmas separate from the first by basifracture, as in the Red Algerian parent. As a consequence, there is no doubt that in its classification it belongs to the cultivated red oat group, *A. byzantina*. Under most conditions it ripens in midseason, stands well in the field after ripening because of a very stiff straw, and produces plump grains and short to midlong, red to grayish-red lemmas, the first lemmas always bearing weak awns. It is extremely resistant to weathering in the field after ripening. Bond lacks winter resistance and is primarily a spring oat. It is highly resistant to nearly all physiologic races of crown rust and to some physiologic races of the oat smuts. These pathological reactions are useful for the identification of the variety.

History.—Bond (C. I. 2733, P. I. 80228) (*178, pp. 67–675*) was received from Australia in 1929 by the United States Department of Agriculture, together with several other newly developed Australian hybrid varieties (*197*).

The following additional information relative to the pedigree of Bond was received from Director H. Wenholz:[9]

> Bond is of the breeding *Avena sterilis* x Golden Rain . . . The *A. sterilis* strain used in this cross was received from Dr. Trabut, of Algeria, in 1918 and was described as a sport from the wild red oat *A. sterilis*.

As yet Bond has not been distributed in the United States for commercial culture, but it has been used widely in extensive hybridization experiments with the development of many new economic varieties of both spring and winter oats.

Distribution.—None.

Camellia

Description.—Camellia differs from Bond in growing a little taller, maturing later, and in making a more vigorous early growth. It has very little winter resistance and is primarily a spring-type red oat. In spikelet characters it differs from Bond in having plumper grains and more reddish lemmas. Camellia is resistant to the older races of crown rust but only moderately resistant to the newer ones, such as races 45 and 47. It is resistant to Victoria blight and many races of the oat smuts. Camellia is a somewhat variable variety, but it has been sufficiently uniform for all practical purposes. It is a rather distinct new type of red oats of some taxonomic interest.

History.—Camellia (C. I. 4079, Louisiana No. 629) was selected from a cross between Bond and Alber by the Louisiana Agricultural Experiment Station at Baton Rouge. It was first distributed to farmers of southern Louisiana in the fall of 1942 (*158, 209*). The plant material from which Louisiana No. 629, later named Camellia, was selected and developed by John Gray of that station. It had been previously tested for resistance to crown rust by H. C. Murphy at Ames, Iowa. The cross between Bond and Alber was made in the greenhouse at Arlington Farm, Rosslyn, Va., by the writer in 1933.

Distribution.—Grown in southern Louisiana and the gulf coast area of Texas, and to a very limited extent in northern Florida and southern Alabama and Mississippi.

Belar

Description.—Juvenile growth semiprostrate to erect; plants midseason to late, midtall to tall (90 to 140 cm.); culms small to midsized, weak, glabrous or slightly hairy at the nodes; sheaths light-green, glabrous or slightly hairy; culm leaves narrow, margins glabrous or slightly hairy on lower third; peduncles small, straight, usually fully exserted; panicles equilateral, very drooping, small to midsized, midlong, narrow to midbroad, ovate; rachises flexuous, nodes 4 to 6; branches short, drooping or ascend-

[9] Letter from W. Wenholz, Director of Plant Breeding, Department of Agriculture, New South Wales, to T. R. Stanton, October 2, 1931.

ing, scabrous; spikelets usually few, usually 2-flowered, separating from pedicels by abscission and leaving small basal scars (suckermouths); florets separating by basifracture; glumes 22 to 30 mm. long, 6 to 8 mm. wide, 7- to 9-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas grayish-red; first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs few or absent; awns numerous, usually dark-colored on lower parts, twisted and subgeniculate to geniculate, 20 to 30 mm. long; caryopses 8.5 to 10.5 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 6.5 to 8.5 mm. long; *second floret rachilla segments* glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 43.

FIGURE 43.—Spikelets and florets of Belar. (× 1.)

Belar, a spring red oat, lacking in winter hardiness, usually may be recognized by its tall straw, rather late maturity, very drooping, lax panicles, and midlong to long lemmas with numerous, twisted and subgeniculate to geniculate awns. It is one of the few cultivated varieties that is distinctly a *sterilis*-type in floret separation with twisted and subgeniculate to geniculate awns and few or no basal hairs. These characters make Belar rather distinct, although the variety is not too uniform morphologically.

History.—Belar (C. I. 2760) was developed by the Department of Agriculture of New South Wales, Australia, in 1918 by J. T. Pridham, as a selection from Sunrise. Belar was first distributed to farmers of New South Wales in 1920, and is today grown to a limited extent in New South Wales (*156, p. 495*).

Distribution.—Grown to a very limited extent.

Red Algerian

Description.—Similar to Red Rustproof except for the following characters: Juvenile growth semiprostrate to erect; plants late, short to midtall (70 to 115 cm.); glumes 26 to 32 mm. long; grains midplump to plump; first lemmas very long (22 to 26 mm.); caryopses 9 to 11 mm. long; second lemmas awns numerous. Spikelets and florets are shown in figure 44.

Red Algerian, a spring red oat, differs morphologically from Red Rustproof only in having slightly longer glumes and lemmas, in having slightly taller culms, and under some conditions in being a little later in maturity. Although these two varieties are difficult to separate morphologically on the basis of grain characters, Red Algerian is distinct in its adaptation and has never attained any commercial importance in the United States because of its inability to compete successfully with the hardier and better adapted Red Rustproof variety (*205*). However, a few morphologically similar Red Algerian strains have shown moderate resistance to crown rust, which has made them of some economic importance, especially in the lower South.

History.—Red Algerian (C. I. 840) is the native cultivated red oat of Algeria of which many introductions have been made into this country such as P. I. Nos. 10269, 12133, 26899, 42090, 46565, 48090, 48115, 48116, 57043, 57677, 58033, 101020, 101021, and 101022 (*197*).

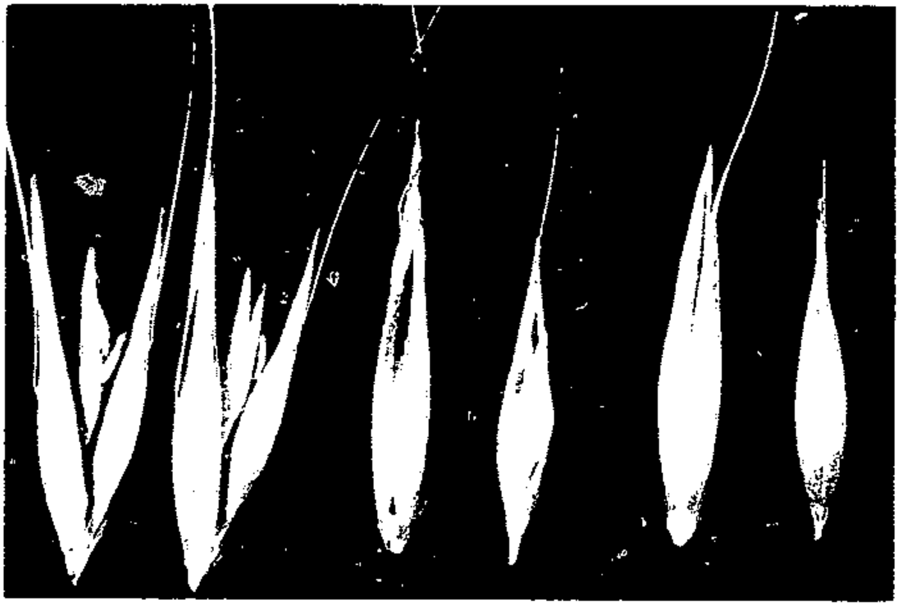
Distribution.—Grown to a very limited extent.

Synonyms.—Algerian Cape, Argentina, College Algerians, La Prevision No. 13, River Plate, Sidonian, Smyrna.

Several strains of red oats, all typical of the Red Algerian variety, have been introduced under the name of "Algerian Cape," Argentina (C. I. 3284) is a strain of Red Algerian received from Argentina, South America. This name appears to be used quite commonly as a name for Red Algerian oats coming from that country.

College Algerians (C. I. 2052) (*77*) was developed from a commercial stock of Red Algerian at Canterbury Agricultural College, Lincoln, New Zealand, as a pure line known as Strain A86, by F. W. Hilgendorf. Under New Zealand conditions its superior characters are high tillering power and cold resistance. College Algerians has not been promising in the United States.

La Prevision No. 13 (P. I. 144293, C. I. 4233) (*197*) is a selected strain of Red Algerian introduced in 1942 by the United States Department of Agriculture from Argentina. It is now the most important variety grown in Argentina, being superior to all other varieties for both grain and forage. So far it has not



F[illegible] 11.[illegible] S[illegible] and [illegible] of Red Algerian [illegible]

[illegible] the United States.

R[illegible] S[illegible] Si[illegible] its names appear to stand [illegible] Red Algerian [illegible] Algeria[illegible] in the [illegible] Cape Province [illegible] South Africa[illegible] These [illegible] has not been [illegible] Red Algerian [illegible]

Alber

Description. — Alber differs from Red Algerian [illegible] resistance to [illegible] but [illegible] the newer [illegible] Victoria blight and [illegible] of the oat smuts. Alber has [illegible] and is [illegible]

History. — Alber (C. I. 2766) was [illegible] the Plant Pathology Section [illegible] Experiment [illegible] Jose M. Scasso [illegible] Province of [illegible] under the des[illegible] Avena [illegible] developed at [illegible] Colonia [illegible] Boerger [illegible]

[illegible]

Berger

Description. — Berger, a spring red oat, differs from Alber in being more uniform in plant and grain characters, but [illegible] variety it has only moderate resistance to the newer races of crown rust. It [illegible] is resistant to Victoria blight and most races of the oat smuts.

History. — Berger (C. I. 2926) (7?) was received by the Cereal Crops Section, United States Department of Agriculture, directly from Alberto Boerger, La Estanzuela, Departamento Colonia, Uruguay, in 1930. It was designated as "Avena 1095a1322," apparently a reselection from the parent population later named "Alber."

Distribution. — Grown to a very [illegible] ted extent in southern Louisiana.

Landhafer

Description. — Landhafer, [illegible] spring red oat, differs from Red Algerian in being [illegible] It is a very vigorous oat when grown in [illegible] South. Landhafer is resistant to many races of crown rust, particularly to races 45, 57, and [illegible] races that have become destructive in recent years. As a consequence, Landhafer has been used extensively in crosses for the development of agronomic varieties resistant to these races. It also is resistant to Victoria blight and [illegible] of the oat smuts.

History.—Landhafer (C. I. 3522), also known as Landhafer aus Uruguay (No. 1675), was received from W. Straib of Germany in 1938, by H. C. Murphy of the United States Department of Agriculture and the Iowa Agricultural Experiment Station for use as a differential host, or tester variety, for the identification of physiologic races of crown rust of oats. It appears that seed of Landhafer was carried from Uruguay to Germany by G. Gassner, a German scientist who worked in Germany sometime between 1909 and 1915.

In the United States Landhafer has proved to be a most valuable variety for use in crosses for the development of economic varieties of oats resistant to the newer physiologic races of crown rust.

Distribution.—None.

Navarro

Description.—Juvenile growth semiprostrate to erect; plants early to midseason, short (60 to 90 cm.), very glaucous (purplish bloom); culms midsized, stiff, slightly hairy at the nodes, purplish-red at maturity; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins glabrous or slightly ciliate on lower third; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, small, short, narrow, ovate; rachises usually slightly flexuous, nodes 4 to 6; branches short, ascending, scabrous; spikelets usually few, usually 3-flowered, occasionally 4-flowered, separating from pedicels by semiabscission or fracture; florets separating by basifracture; glumes 22 to 26 mm. long, 7 to 10 mm. wide, 9- to 11-veined, very light-green and very glaucous before maturity; grains plump; lemmas reddish-yellow; first lemmas midlong (15 to 18 mm.), glabrous; basal hairs few or absent; awns few or absent (rare); caryopses 6 to 9 mm. long; second lemmas 12 to 15 mm. long; awns absent; caryopses 3 to 5 mm. long; second floret rachilla segments glabrous, very short (0.5 to 1.5 mm.); third lemmas 6 to 9 mm. long; awns absent; third floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 45.

Navarro is distinguished by three outstanding characters; namely, by the distinct, beautiful, purplish bloom that covers the entire plant during the heading period, the tendency to produce 3 or even 4 florets to the spikelet, and by the exceedingly short second floret rachilla segments. The spikelets separate from their pedicels by semiabscission or by fracture, similar to that of the Fulghum oat and some strains of the Burt variety.

FIGURE 45.—Spikelets and florets of Navarro. (× ⅔.)

The type of spikelet separation makes Navarro more or less intermediate between varieties of *A. sativa* and *A. byzantina*, thus suggesting a hybrid origin. The second florets separate from the first florets by basifracture as in the Red Rustproof variety, but differ markedly in having short second floret rachilla segments (fig. 45). The third florets usually separate from the second ones by disarticulation, and possess rachilla segments 2 to 3 mm. in length. Navarro is almost completely awnless. The color of the lemma is best described as reddish yellow, a slightly darker yellow than is found in the more intensive yellow varieties of *A. sativa*. The straw of Navarro has the reddish tinge that is characteristic of red oat varieties. Navarro is resistant to Victoria blight and the smuts of oats, including the physiologic races that attack red oats as well as the virulent new races that attack varieties derived from Victoria oats. It is only slightly winter hardy and is primarily a spring variety.

History.—Navarro (C. I. 906) is a distinct variety that apparently originated in North America (*155*). The variety was first brought to the attention of the writer about 1921 by A. M. Ferguson, of the Ferguson Seed Farms, Sherman, Tex., under the name of "Three Grain Mesh." According to Mr. Ferguson[10] Navarro is a distinct variety different from anything he has ever encountered and its origin is unknown. It was received from a farmer who reported that it had occurred as a "stray" plant in his oatfield.

Ferguson further wrote[11] as follows:

> About 1919, the Rev. J. W. Hornbeak of Navarro County called my attention to a strain of oats that was grown by a farmer in his community. I obtained samples of this, and endeav-

[10] Letter from A. M. Ferguson, Sherman, Tex., dated May 23, 1921.

[11] Letter from A. M. Ferguson, Sherman, Tex., dated July 4, 1929.

ored to secure something of its earlier history but could not get very much. But in this material was found what we first distinguished as "Three Grain Mesh" oats, referring to the rather constant character of three grains to the spikelet. This name was used in our private records. Later on, we offered it for sale as a novelty, but not with a recommendation as to any specific value under the name of Ferguson Navarro oats, the word Navarro referring to Navarro County, Texas.

We continued to propagate this oat and "project" with it through a number of years. Its susceptibility to rust and a lack of drought-resisting abilities indicated that it was quite inferior to other strains of red oats. It was outstanding and attractive in appearance. It would produce to a rather high degree the three-grain character of the spikelet and had a rather attractive, round, plump grain. Its yielding qualities in our tests were not sufficiently promising. . .

Navarro has been distributed to agricultural experiment stations and to a few farmers, but it has not attained any economic importance, primarily because of its low productiveness. Navarro undoubtedly will prove of most value for plant-breeding purposes, especially as a smut-resistant parent (*156, p. 396*).

Distribution.—Grown to a very limited extent.

Synonym.—Three-Grain Mesh.

Segetal

Description. Juvenile growth erect; plants midseason to late, midtall (90 to 115 cm.), slightly glaucous at time of full heading; culms midsized, stiff, glabrous or slightly hairy at the nodes, yellowish at maturity; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins glabrous or slightly ciliate on lower third; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, small to midsized, midlong, midbroad, ovate; rachises flexuous, nodes 5 to 8; branches midlong, drooping, scabrous; spikelets numerous, 2- to 3-flowered, separating from pedicels by abscission leaving small, but distinct basal scars (suckermouths); florets separating by barifracture; glumes 20 to 26 mm. long, 6 to 8 mm. wide, 7- to 9-veined, light-green and slightly glaucous before maturity; grains plump; lemmas yellow; first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs numerous, short; awns few or absent; caryopses 8 to 10 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments hairy at upper ends, very short (0.5 to 1.0 mm.). Spikelets and florets are shown in figure 46.

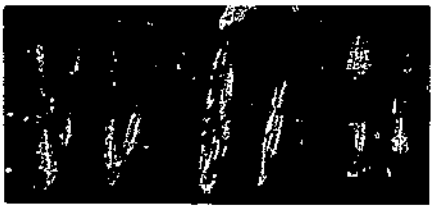


FIGURE 46.—Spikelets and florets of Segetal. (× 4½.)

Segetal, a spring oat, is a very distinct morphological type. It differs from Navarro primarily in having no distinct purplish bloom, in having spikelets that separate by abscission and leave small but distinct basal cavities, and in having many very short, fine basal hairs. In certain plant characters, such as color of straw and size and form of panicle, Segetal has a closer resemblance to *A. sativa* than to *A. byzantina*. In spikelet and floret separation, however, it is more typical of red oats than is Navarro. The adherence of the second florets to the first ones in Segetal also is much stronger than in Navarro. On the basis of this character alone the variety is classified as belonging to *A. byzantina*.

History.—Segetal (C. I. 2137, P. I. 60769) was received as an introduction from the late N. I. Vavilov, of the Bureau of Applied Botany, Genetics, and Plant Breeding, Leningrad, U. S. S. R., in 1924, under the name of *Avena sativa* L. *diffusa* Asch. & Graeb. var. *segetalis* (*197*). It is a selection taken as a mixture from *Triticum dicoccum*.

Distribution.—Grown to a very limited extent.

Synonym.—Volgen (C. I. 2138).

Volgen, a similar, if not identical, strain was received at the same time as Segetal from the same institution under the name of "*A. sativa* L. *diffusa* Asch. & Graeb. var. *volgensis*" (P. I. 60770) (*197*). T. R. Stanton anglicized "volgensis" to the common name "Volgen" for this variety, just as the name "Segetal" was applied to the variety "Segetalis." It is of little economic importance in the United States, but it may prove to be of considerable taxonomic interest.

Trisperma

Description.—Juvenile growth semiprostrate to erect; plants very late, midtall to tall (90 to 140 cm.), only slightly glaucous at time of full heading; culms

midsized, stiff, usually slightly hairy at the nodes, yellowish-red at maturity; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide to wide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate; rachises very flexuous, nodes 5 to 7; branches midlong to long, ascending, scabrous; spikelets few to numerous, 2- to 3-flowered, separating from pedicels by semiabscission, leaving small, obscure basal scars (*suckermouths*); florets separating by basifracture; glumes 22 to 28 mm. long, 7 to 9 mm. wide, 9- to 11-veined, light-green and glaucous before maturity; grains midplump; lemmas yellow; first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs numerous, short; awns numerous, occasionally dark-colored on lower parts, nontwisted to twisted and subgeniculate, 15 to 35 mm. long; caryopses 7.5 to 9.5 mm. long; second lemmas 12 to 17 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments sparsely hairy, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 47.

FIGURE 47.—Spikelets and florets of Trisperma. (× ⅞.)

Trisperma is a distinct very late maturing spring variety that resembles common oats when growing in the field, but in spikelet and floret separation it is distinctly of the *sterilis or byzantina* type. In these characters it is very similar to Segetal. It definitely is a variety of *A. byzantina*. All spikelets of Trisperma are awned. The awns are long with little or no geniculation, whereas Segetal is almost completely awnless.

History.—Trisperma (C. I. 1776) was received by the United States Department of Agriculture, in 1917, from George M. Reed, then head of the Department of Botany, University of Missouri. Trisperma, along with several other European varieties, had been obtained by Reed from Franc Bubak, of the Botanical Garden of Tabor, Bohemia, under the name "*A. sativa* var. *trisperma*," which name was used by Körnicke and Werner (*93*). For simplicity, the name "Trisperma" has been applied by the writer as a common name for the variety.

Distribution.—None.

Cuired

Description.—Juvenile growth prostrate; plants midseason to late, short to midtall (70 to 110 cm.); culms midsized, fairly stiff, usually slightly hairy at the nodes; sheaths dark-green, hairy; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small, straight, fully exserted; panicles equilateral, usually erect, midsized, short to midlong, midbroad, ovate; rachises usually slightly flexuous, nodes 5 to 6; branches short to midlong, ascending or spreading, scabrous; spikelets few to numerous, usually 2-flowered, rarely 3-flowered, separating from pedicels by abscission leaving small, distinct basal scars (suckermouths); florets separating by basifracture; glumes 20 to 26 mm. long, 6.5 to 8.5 mm. wide, usually 9-veined, very light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas gray; first lemmas midlong (15 to 18 mm.), glabrous; basal hairs numerous, midlong to long; awns numerous, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 8.5 to 10.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; second floret rachilla segments glabrous or sparsely hairy, long (2.5 to 3.0 mm.). Spikelets and florets are shown in figure 48.

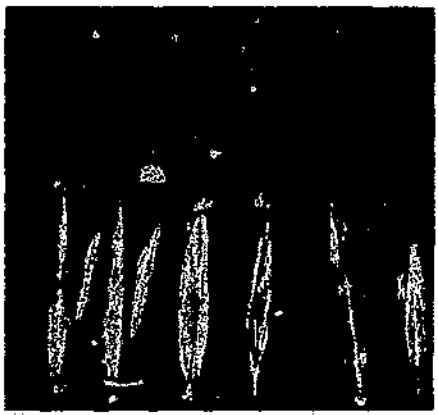


FIGURE 48.—Spikelets and florets of Cuired. (× 1⅛.)

Culred is a rather distinct type of winter oats belonging to the *A. byzantina* group. Its slender to midplump grains, gray lemmas, and awnless second lemmas aid in identifying the variety. However, the mode of both the spikelet and floret separation of Culred definitely determine its classification as belonging to *A. byzantina*.

History.—Culred (C. I. 3217, Sel. 581a1–7–3) originated from a hybrid between Red Rustproof and Culberson made about 1905 or 1906 by the late Jesse B. Norton. A second strain (518–189) of the variety was selected from Red Rustproof by the writer in 1918 at the Arlington Farm, Rosslyn, Va., in which variety it either occurred as a mechanical mixture of 581a1–7–3 or as a segregate from a natural hybrid (*159, p. 15*). This second strain (C. I. 3218) has been chosen as the elemental varietal type because of its slightly greater uniformity. The two strains usually have been considered morphologically identical, although there are slight differences in a few minute characters.

Distribution.—Grown to a very limited extent.

Awnless Culred

Description.—Similar to Culred except for the following characters: Juvenile growth semiprostrate; plants early to midseason, tall (90 to 140 cm.); sheaths glabrous or slightly hairy; leaf margins glabrous or slightly hairy on lower third; panicles very large, drooping; branches long, drooping from the middle outward; spikelets separating from pedicels more frequently by fracture than by semiabscission; grains slender; first lemmas short to midlong (14 to 17 mm.); basal hairs few to several, long; awns few or absent; caryopses 8 to 10 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 49.

FIGURE 49.—Spikelets and florets of Awnless Culred. (× 1¼.)

Awnless Culred, a spring oat, lacks winter hardiness, has larger and more lax panicles, and has fewer awns and basal hairs than Culred. It represents a variety of *A. byzantina* that is almost completely awnless, which makes the variety of considerable taxonomic and phylogenic interest and provides a definite mark of identification.

History.—Awnless Culred (C. I. 2676) was introduced by the United States Department of Agriculture from the Mediterranean region of Europe or Africa under the erroneous name "*A. sterilis* var. *ludoviciana*." It has not been possible, however, to trace its history definitely. A sample of seed of the variety under the name "Cornell No. 2" was received from H. H. Love of the Department of Plant Breeding at Cornell University, Ithaca, N. Y., in 1925. It has been used as one parent in various crosses for investigations on the inheritance of certain grain characters in *Avena* at Cornell University.

Distribution.—Grown to a very limited extent.

Burt

Description.—Juvenile growth erect; plants very early, midtall to tall (80 to 130 cm.); culms small to midsized, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins usually glabrous; peduncles small to midsized, straight, fully exserted; panicles equilateral, drooping, small to midsized, midlong, narrow, ovate; rachises usually slightly flexuous, nodes 4 to 7; branches short to midlong, spreading or ascending, occasionally drooping from the middle outward, scabrous; spikelets few to numerous, usually 2-flowered, separating from pedicels by semiabscission, or fracture; florets separating by basifracture, heterofracture (intermediate), or by disarticulation; glumes 22 to 28 mm. long, 5 to 7 mm. wide, 7- to 9-veined, light-green and somewhat glaucous before maturity; grains very slender; lemmas red to grayish-red (variable); first lemmas midlong to very long (18 to 24 mm.), glabrous; basal hairs few to several, short to long; awns few to numerous, nontwisted to twisted and geniculate, 30 to 35 mm. long; caryopses 8.5 to 10.5 mm. long; second lemmas 30 to 16 mm. long; awns few to common, usually nontwisted, 10 to 25 mm. long; caryopses 6 to 8 mm. long; second floret rachilla segments usually glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 50.

One of the outstanding characteristics of the Burt variety is its great variability in plant and grain characters (*37*). In spite of this variability, the high-yield-

FIGURE 50.—Spikelets and florets of Burt. (× ⅔.)

ing power of Burt has made it of economic value. It is one of the earliest maturing spring varieties known. The typical Burt oat usually grows a little taller than Red Rustproof, but in grain characters it is very similar, except that the grains are more slender.

History.—Parker in 1920 (*124, pp. 26–28*) published a brief statement on the origin of Burt (C. I. 293). This information was furnished primarily by the Livingston Seed Co., Columbus, Ohio, to the late C. W. Warburton and to C. A. Mooers, of the Tennessee Agricultural Experiment Station. Briefly, these statements indicate that the variety originated in Greene County in southern Alabama in 1878 by a farmer named Burt, who noticed in his field of spring oats, presumably Red Rustproof, a plant that was ripe while others around it were still green. The seed from this one plant was carefully saved and increased by Mr. Burt. Burt is an exceedingly variable variety, and its classification is difficult (*57*).[12]

In the 1919 oat varietal survey, Burt was grown on about 500,000 acres; however, since that time it has been replaced by varieties such as Fulghum and Columbia, and later by improved disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Synonyms.—Early Bird, Early Harvest, Early May, Early Ripe, Early Six Weeks, Gaulin, June, Little Red Rustproof.

The origin of the Early Bird (C. I. 1222) and Early Harvest (C. I. 2803) strains has not been determined. Early Bird has been reported from Kansas and Early Harvest was formerly grown to a limited extent in Iowa and Illinois. The Early May (C. I. 2828) strain was so designated because it matured in May. It was formerly grown rather generally in the Southern States. Nothing is known concerning the origin of the Early Ripe (C. I. 244) strain. It apparently was first placed on the market in 1898 by A. W. Livingston, Seedsman, Columbus, Ohio. Early Ripe is one of the best known Burt strains and formerly was grown to some extent in Ohio and to a less extent in a few other States. It also was grown to a very limited extent in Ontario, Canada. Early Six Weeks (C. I. 2901) is a strain of Burt reported from Illinois and Iowa in 1919. The Gaulin (C. I. 2903) and June (C. I. 710) strains were reported from Illinois, the former in 1919. No information is available on their origin. The origin of the Little Red Rustproof strain (C. I. 1428), reported from Texas, is not known.

Otoe

Description.—Differs from Burt in being somewhat more uniform in plant and grain characters and in having some resistance to certain races of stem rust. It is also a little more drought resistant.

History.—Otoe (C. I. 2886, Nebr. 518) (*5*) originated as one of several hundred selections from commercial Burt oats made by Arthur Anderson and T. A. Kiesselbach of the Nebraska Agricultural Experiment Station at Lincoln in 1920. It was first distributed to farmers in Nebraska in 1941 and registered as an improved variety (*154, p. 34*).

Distribution.—Grown to a limited extent in the drier areas of Nebraska and adjoining States.

Brunker

Description.—Similar to Burt except for the following characters: Plants short to midtall (70 to 110 cm.); culms small, weak, slightly hairy at the nodes; leaf margins usually ciliate on lower third; panicles small, short, narrow to midbroad; branches spreading or drooping; florets usually separating by disarticulation; grains slender; lemmas red; first lemmas midlong to long (16 to 20 mm.); basal hairs few to several, midlong; awns few or absent; second lemmas 12 to 15 mm. long; awns absent. Spikelets and florets are shown in figure 51.

Brunker, a spring variety, differs mainly from the original Burt in being more uniform in plant characters and being more of an intermediate type be-

[12] The writer has made no attempt to present a description that will cover all the numerous types occurring in Burt. The description given herein is intended to apply to that type which is commonly considered as typical Burt, or the one by which the variety is usually recognized, which is a red oat type.

FIGURE 51.—Spikelets and florets of Brunker. (× 1.)

tween common and red oats. Owing to its reddish, very fine, and rather weak straw, its tendency toward awnlessness, and rather prominent lemma veins, Brunker is usually fairly easily identified. It is resistant to certain physiologic races of the oat smuts and is an excellent dryland variety.

History.—Brunker (C. I. 2054) originated as a pure line from Burt, isolated by F. A. Coffman, at the Akron Field Station, Akron, Colo., of the United States Department of Agriculture in 1919. Brunker was grown in head row No. 16 in 1919; hence, it was known as Burt No. 916. The collection of panicles used for sowing this series of head rows was made by the writer from fields of Burt in the Southeastern States during a field trip in the spring of 1918. Brunker was first distributed to farmers in 1929 and was registered as an improved variety (*160*).

Distribution.—Grown in Colorado, Kansas, Nebraska, and South Dakota.

Neosho

Description.—Juvenile growth erect; plants very early, short (60 to 90 cm.); culms small to midsized, very stiff, glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide to wide, margins glabrous; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, small, short to midlong, narrow to midbroad ovate; rachises usually slightly flexuous, nodes 3 to 5; branches short to midlong, usually spreading or ascending, scabrous; spikelets usually few, 2- to 3-flowered, separating from pedicels by semiabscission or fracture; florets separating by disarticulation or basifracture; glumes 18 to 24 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains midplump to plump; lemmas red to yellowish-red; first lemmas short to midlong (14 to 17 mm.), glabrous; basal hairs several to numerous, midlong; awns few to common, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 8 to 11 mm. long; second lemmas 10 to 15 mm. long; awns absent; caryopses 6 to 9 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 52.

FIGURE 52.—Spikelets and florets of Neosho. (× 1.)

Neosho, a spring variety, may be differentiated by its short, stiff culms, almost complete absence of hairs at the culm nodes, reddish, short to midlong lemmas, midplump to plump grains, and numerous basal hairs. It is still slightly variable and may need purification. Neosho is resistant to many races of the rusts and to nearly all races of the oat smuts, but is susceptible to Victoria blight.

History.—Neosho (C. I. 4141) originated as a selection from the cross (Fulghum-Markton) × (Victoria-Richland), made at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1935, by F. A. Coffman and Harland Stevens (*34*). The selection giving rise to Neosho was subsequently developed, increased, named, and distributed by the Kansas Agricultural Experiment Station at Manhattan, Kans., in cooperation with the United States Department of Agriculture. E. G. Heyne and C. O. Johnston had a part in its development at Manhattan, from where it was first distributed for growing on Kansas farms in 1945. It was registered as an improved variety (*154, p. 42*). Neosho suffered severely from Victoria blight in eastern Kansas in 1947 and is now being replaced by resistant varieties.

Distribution.—Grown to some extent in Kansas.

Fulghum

Description.—Juvenile growth semiprostrate to erect; plants early, short to midtall (70 to 110 cm.); culms small to midsized, fairly stiff, glabrous or slightly hairy at nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves nar-

row to midwide, margins usually ciliate on lower third; peduncles small to midsized, straight, fully exserted; panicles equilateral, erect, small, short to midlong, narrow, ovate; rachises usually slightly flexuous, nodes 4 to 6; branches short, usually ascending, scabrous; spikelets usually few, 2- to 3-flowered, separating from pedicels by semiabscission or fracture; one-half or more of florets separating by disarticulation, other by basifracture; *glumes* 22 to 28 mm. long, 6 to 8 mm. wide, usually 9- to 11-veined, light-green and slightly glaucous before maturity; grains slender to midplump; lemmas red to grayish-red (buff); *first lemmas* mid long to long (16 to 20 mm.), glabrous; basal hairs few to several, midlong; awns common, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 8 to 10 mm. long; second lemmas 12 to 15 mm. long; awns usually absent; caryopses 6 to 8 mm. long; second floret rachilla segments usually glabrous, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 53.

FIGURE 53.—Spikelets and florets of Fulghum. (× 1½.)

Fulghum, a semiwinter type, is sometimes confused with Red Rustproof but can be usually differentiated from that variety by its more erect panicles in the field, less prostrate habit of juvenile growth, slightly more slender grains, buff-colored lemmas, and in having fewer awns and basal hairs. Many aberrants, or offtypes, occur in Fulghum that range from various-colored cultivated to the wildlike types known as fatuoids, or "false wild" oats (*39, 167*). This marked variability of Fulghum has offered opportunities for improvement by selection, but so far very few absolutely pure-breeding strains of the Fulghum type have been developed, although thousands of pure-line progenies have been grown and studied.

Owing to variability in type of floret separation De Villiers and Sim (*51*) classified Fulghum as belonging to *A. sativa*. The role this character plays in the separation of *A. sativa* and *A. fatua* from *A. byzantina* and *A. sterilis* already has been discussed (p. 31). De Villiers and Sim (*51, p. 11*) investigated this character in Fulghum and found that around 50 percent of the second florets separate from their supporting rachilla segments by disarticulation as in typical varieties of *A. sativa*. These writers were of the opinion that the variability in type of floret separation was not altogether trustworthy for classification purposes. In the samples studied approximately 60 percent of the upper florets separated from the lower florets by disarticulation (leaving the rachilla attached to the lower florets or lemmas), and 40 percent separated by rupture of the rachilla (leaving part of it attached to the upper florets). The material used in their study was pure, and it was difficult to account for such variation in a presumably fixed morphological character. De Villiers and Sim believed that possibly some climatic or soil condition might have been the cause of hardening of the tissues, thus preventing disarticulation of the 40 percent. On the other hand, they point out that this particular variety had certain peculiar characteristics, such as having only 2-awned florets in a panicle of 40 or more. It is possible that the variation in floret separation is another peculiarity of the variety.

The writer studied floret separation in Fulghum and fully agrees with De Villiers and Sim (*51*) that the variety is intermediate in this character and that it may be classified as a common oat. However, as usually not more than 50 percent of the florets under most conditions in the United States separate by disarticulation and as it has reddish glumes and straw, nontwisted, weak awns, and other typical red oat characters, Fulghum more properly belongs in the red oat group. Salmon and Parker (*137*) advanced the theory that Fulghum is of hybrid origin, owing to many characters of the variety being intermediate as between red and common oats. They also pointed out that in adaptation it occupies an intermediate geographic position between the northern, or common, oat region and the southern, or red, oat region.

History.—The origin of Fulghum (C. I. 708) was first recorded in 1921 (*51*). About 1912 an awnless, very early red oat under the name "Fulghum" was reported as being grown in southeastern Georgia. This oat was originated about 1897 by J. A. Fulghum, on his farm near Warrenton, Ga. He found a single plant bearing 5 panicles that was taller and earlier than the Red Rustproof variety from which it was selected. The seed was in-

creased on his farm and was first distributed about 1900. Later the seed was distributed widely from a source in Augusta, Ga.[17]

In 1919 Fulghum was grown on about 156,000 acres. At that time it was comparatively new as a fall-sown variety and was still unknown as a spring oat. Fulghum and its strains later became the second most important varietal type of red oats grown from both fall and spring seeding in the United States, occupying from 5 to 6 million acres annually (*156, p. 382*). It is now being replaced, however, by improved disease-resistant varieties.

Distribution.—Grown in Arkansas, California, Illinois, Indiana, Kansas, Kentucky, Missouri, Nebraska, New Jersey, North Carolina, Ohio, Oklahoma, Oregon, Tennessee, Texas, and Virginia.

Synonyms.—Coker Fulghum No. 4, King, Marett Fulghum.

Coker Fulghum No. 4 (C. I. 3166) is a strain of Fulghum selected and placed on the market by the Coker's Pedigreed Seed Co., Hartsville, S. C. Coker Fulghum Nos. 1, 2, 3, and 4 replaced each other in succession and the No. 4 is now little grown. The Coker Fulghum Nos. 1, 2, and 3 strains were quite typical of Fulghum. Coker Fulghum No. 4, however, differs in having a little plumper grain and slightly more cold resistance.

Etheridge (*61, p. 130*) described Fulghum under the name of "King" (C. I. 850). The source of this strain is undetermined and apparently it is little grown.

Marett Fulghum (C. I. 3919), a strain (No. 34-4-17-20) of Fulghum, was selected and commercialized by the Marett Farm & Seed Co., Westminster, S. C. (*106, 1940–41*). It is grown to a very limited extent in the Carolinas and other Southern States.

Frazier

Description.—Frazier, a semiwinter red oat, differs from Fulghum in having more awns, the second floret occasionally carrying an awn as in typical Red Rustproof. The grains are more slender, however, than those of the Red Rustproof type and the lemmas are lighter red or buff color as in Fulghum. Frazier, like Fulghum, also produces many fatuoids.

History.—Frazier (C. I. 2381, Tex. No. 765–16–1) originated as a plant selection from a mass stock of early red oats by the Texas Agricultural Experiment Station at Substation No. 6, Denton. The mixed populations from which Frazier was selected was obtained from a Texas farmer of that name and was known as Frazier's Red Rustproof. Frazier is registered as an improved variety (*171*). Frazier has been replaced by disease-resistant varieties.

Distribution.—Grown to some extent in north-central Texas.

Synonym.—Frazier's Red Rustproof.

Kanota

Description.—Kanota, a semiwinter to spring type red oat, differs from Fulghum in being slightly more uniform in plant and grain characters and producing fewer fatuoids than the original Fulghum (C. I. 708). The grains also are slightly more slender, and the lemmas usually have fewer awns.

History.—Kanota (C. I. 839), because of its extensive culture in Kansas during the two decades 1921 to 1940, is the most important commercial oat of the Fulghum type. Kanota is the progeny of a stock of Fulghum placed on the market around 1916 under the name of "[Nicholson's] New Extra Early Improved Red Rust Proof" by the Robert Nicholson Seed Co., Dallas, Tex. This oat was mass selected, tested, named, and distributed by the Kansas Agricultural Experiment Station as an improved variety under the name of "Kanota" (*137, 151, 171*).

Distribution.—Grown to a very limited extent from spring seeding in Arizona, Arkansas, California, Illinois, Indiana, Kansas, Kentucky, Missouri, Nebraska, Oklahoma, Oregon, Tennessee, Texas, and Virginia.

Synonyms.—Kansas Fulghum, [Nicholson's] New Extra Early Improved Red Rust Proof (*117*).

Kureela

Description.—Kureela, primarily a spring variety, differs from Fulghum in having a lighter green color at time of heading, in ripening a few days later, and in growing a little taller. It is very susceptible to halo blight and smut, but has some resistance to certain physiologic races of crown rust occurring in Iowa and Kansas. Kureela produces many chlorophyll-deficient or so-called red-leaf plants.

History.—Kureela (C. I. 2774) (*173, pp. 675–676*) (P. I. 80760) (*197*) originated as a selection from Fulghum (C. I. 708), made by H. Wenholz, Director of Plant Breeding, Department of Agriculture, New South Wales. It was presented to the United States Department of Agriculture by J. T. Pridham, plant breeder, Experimental Farm, Cowra, New South Wales. Kureela was received as Kureela

[17] Letter from Ralph M. Fulghum, grandson of J. A. Fulghum, to T. R. Stanton, dated December 29, 1936.

C. 28 on March 21, 1919 (*197*). Fulghum was sent to Australia for experimental purposes in 1929 by the United States Department of Agriculture.

Distribution.—Grown to a very limited extent.

Quincy Red

Description.—Quincy Red, a spring red oat, differs from Fulghum in having slightly plumper grains and numerous strong awns. It is a slightly variable oat. Quincy Red is resistant to many races of crown rust and the oat smuts but susceptible to Victoria blight.

History.—Quincy Red (C. I. 4077), also known as Quincy 1 (*158, p. 57*), originated from a cross between Kanota (Fulghum) and Victoria made at Arlington Farm, Rosslyn, Va., in 1930, by F. A. Coffman. Certain selections of this cross were first tested at Ames, Iowa, and then at Experiment, Ga., before being sent to Quincy, Fla., for a more rigid test under the severe natural field epidemics of crown rust that occur there. Quincy Red was grown rather extensively in northern Florida and to some extent in the southern parts of Georgia and Alabama, but in 1946 and 1947 it was seriously damaged by Victoria blight and is now of much less economic importance.

Distribution.—Grown to a very limited extent.

Synonym.—Quincy 1.

Franklin

Description.—Similar to Fulghum except for the following characters: Juvenile growth erect; plants midtall to tall (90 to 140 cm.); culms midsized, stiff, slightly hairy at the nodes; panicles midsized; grains midplump to plump; lemmas red; first lemmas short to midlong (14 to 18 mm.); basal hairs few to several, long; awns few or absent; caryopses 7 to 9 mm. long. Spikelets and florets are shown in figure 54.

FIGURE 54.—Spikelets and florets of Franklin. (× 1.)

Franklin, a spring red oat, is differentiated mainly from the parent Fulghum in having a taller and stiffer straw, fewer awns, longer basal hairs, and slightly shorter lemmas, and plumper grains. It is much more uniform in plant characters and is nearly free from the aberrant types that occur so frequently in Fulghum. Under some conditions a higher percentage of the florets may separate by basifracture in Franklin than in Fulghum, thus indicating that Franklin represents a less intermediate type between red and common oats than the parent variety. Franklin is very susceptible to most physiologic races of the oat smuts, especially those specialized to the Fulghum type. Stanton (*156, p. 38*) listed Franklin as an improved variety of spring oats well adapted to southern Ohio.

History.—Franklin (C. I. 2892) originated as a single plant selection from Fulghum (C. I. 708) made in 1922 by H. L. Borst, of the Department of Farm Crops, Ohio State University. Subsequent testing was made by him at Columbus (the Ohio State University and the Ohio Agricultural Experiment Station, cooperating) and by G. H. Stringfield, at the Ohio Agricultural Experiment Station at Wooster. Franklin apparently was first grown commercially on farms in Ohio in 1931 and is registered as an improved variety (*154, v. 23*).

Distribution.—Grown in Ohio, Illinois, and Indiana.

Fulwin

Description.—Juvenile growth prostrate to semiprostrate; plants midseason, midtall to tall (90 to 140 cm.); culms midsized, weak, glabrous or slightly hairy at the nodes; sheaths dark-green, hairy; culm leaves narrow to midwide, margins ciliate on lower third; peduncles midsized, straight, fully exserted; panicles equilateral, erect, or slightly drooping, midsized, midlong to long, midbroad, ovate; rachises usually flexuous, nodes 4 to 7; branches midlong, usually drooping from the middle outward, scabrous; spikelets usually numerous, usually 2-flowered, separating from pedicels by semiabscission or fracture; florets separating by disarticulation; glumes 22 to 26 mm. long, 7 to 9 mm. wide, usually 9-veined, light-green and slightly glaucous before maturity; grains midplump; lemmas red to grayish-red (buff); first lemmas midlong to long (17 to 21 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 9 to 11 mm. long; second lemmas 12 to 16 mm. long, awns absent; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous or slightly hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 55.

Fulwin, a very hardy winter type, is differentiated from Fulghum, the parent

FIGURE 55. Spikelets and florets of Fulwin. (× 1.)

variety, by being a less distinct red oat. The plants grow taller and mature later, and the lemmas are red to grayish red with fewer basal hairs and awns. Except for the reddish straw and lemmas this oat might be equally well classified as a common oat, as the florets separate rather consistently by disarticulation.

History.—Fulwin (C. I. 3168, Tenn. No. 1945) was originated as a reselection from winter Fulghum (Pentagon, sel. 699-2011 and C. I. 2499) by Newman L. Hancock of the Tennessee Agricultural Experiment Station, Knoxville (*69*). The reselection, Tenn. No. 1945, was made in 1930. The original winter-resistant selection, 699-2011, was made by the writer at Arlington Farm, Rosslyn, Va., in 1920 (*158*). Fulwin is registered as an improved variety (*154*, p. *32*).

Distribution.—Grown to a limited extent in Alabama, Arkansas, Georgia, Kentucky, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, and Virginia.

Forkedeer

Description.—Forkedeer, a hardy winter oat, differs from Fulwin in growing about 4 inches shorter, in ripening a little later, and in being slightly less hardy. It also has a stiffer straw.

History.—Forkedeer (C. I. 3170, Tenn. No. 930) is a sib of Fulwin originating from a selection of winter Fulghum (Pentagon, C. I. 2499) and thus has the same history (*69*). It is registered as an improved variety (*154*, p. *42*).

Distribution.—Grown in Alabama, Arkansas, Georgia, Illinois, Indiana, Kentucky, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, Tennessee, and Virginia.

Pentagon

Description.—Pentagon, a very hardy winter oat, differs mainly from Fulwin in being exceedingly variable in many plant and grain characters, thus making it unsuitable for commercial production regardless of its outstanding vigor, hardiness, and yield. Pentagon also usually has a little shorter straw than Fulwin. Like the early red spring oat Burt, this marked variability is its most distinguishing characteristic. High susceptibility to most races of the oat smuts, as is true of all varieties resulting from selection within the original Fulghum oats, aids in its identification.

History.—Pentagon (C. I. 2499) originated as a selection (699-2011) from a typical Fulghum (C. I. 699) made in 1920 by the writer, at Arlington Farm, Rosslyn, Va. (*158*, *159*). The selection C. I. 2499 was never distributed commercially. However, because of its great vigor and value as a winter-hardy red oat parent or breeding material, it was named Pentagon in 1930. It was reselected by N. L. Hancock of the Tennessee Agricultural Experiment Station and has given rise to the hardy so-called winter Fulghum-type varieties.

Distribution.—None.

Tennex

Description.—Tennex, a very hardy winter oat, differs from Fulwin in being a little less prostrate in juvenile growth and usually ripening a few days later. Regardless of these slight variations, however, Tennex is almost identical with Fulwin in nearly all plant and grain characters.

History.—Tennex (C. I. 3169, Tenn. No. 1884) has the same history as Fulwin. Tennex is registered as an improved variety (*154*, p. *32*; *159*).

Distribution.—Grown to a limited extent.

Winter Fulghum

Description.—Winter Fulghum, a semi-winter oat, differs from Fulwin in having larger, plumper grains, darker red lemmas, and stiffer straw.

History.—Winter Fulghum (C. I. 2500) originated as a selection from a typical Fulghum (C. I. 699) (*158*, *159*), being a sib of the selection C. I. 2499, recently named Pentagon.

Distribution.—Grown to a very limited extent in southeastern Missouri.

Victoria

Description.—Juvenile growth semiprostrate to erect; plants late to very late, short to midtall (60 to 100 cm.); culms small to midsized, fairly stiff, glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins usually ciliate on lower third; peduncles small to midsized, straight, occasionally not fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate; rachises usually

flexuous, nodes 4 to 6; branches midlong, ascending or drooping, scabrous; spikelets few, 2- to 3-flowered, separating from pedicels by semiabscission or fracture; florets separating by disarticulation; glumes 26 to 34 mm. long, 7 to 9 mm. wide, 8- to 10-veined, light-green and slightly glaucous before maturity; grains slender to midplump; lemmas red to grayish-red; first lemmas long to very long (19 to 22 mm.), glabrous; basal hairs few to several, short to midlong; awns numerous, dark-colored on lower parts, twisted and geniculate, 25 to 40 mm. long; caryopses 9 to 11 mm. long; second lemmas 12 to 17 mm. long; awns absent; caryopses 7 to 9 mm. long; second floret rachilla segments occasionally sparsely hairy, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 56.

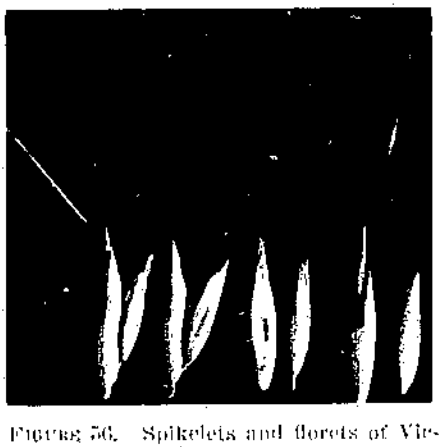


FIGURE 56. Spikelets and florets of Victoria. (× 1.)

Victoria, primarily a spring variety, has some of the characteristics of both common and red oats. In plant and certain grain characters Victoria resembles such varieties as Red Rustproof and Fulghum. The culms and lemmas show the reddish yellow of the varieties belonging to *A. byzantina*; however, the florets separate by disarticulation as they do in varieties of *A. sativa*. The awns are mostly twisted and geniculate. Victoria may have resulted from a hybrid between these species. It usually may be identified in the field by its late maturity, vigorous, heavy-tillering, short-stemmed plants, long, grayish-red lemmas with long twisted and geniculate awns that are dark-colored on lower parts.

Because of its high resistance to crown rust and the smuts of oats and its great vigor, Victoria has been used extensively in breeding experiments for the development of better agronomic varieties with resistance to these diseases. So far, Victoria has shown resistance to nearly all the physiologic races of crown rust and the oat smuts, but it is susceptible to Victoria blight.

History.—Victoria (C. I. 2401) was introduced into the United States in 1927 (*173*). According to Enrique Klein of the Criadero Argentina de Plantas Agrícolas, Pla, Argentina, and Alberto Boerger, Instituto Fitotecnico y Semillero Nacional, at "La Estanzuela" Departamento Colonia, Uruguay, Victoria was originated as a selection from a variety that had been grown continuously for some years in Uruguay. It is an artificial (mass) population of the three lines 64q, 64r, and 64t that was increased and distributed in Argentina. A second strain of this varietal type was received under the name "Avena Victoria" and was distributed to a few experiment stations under the name "Scasso" (C. I. 2764), as it was received from Jose M. Scasso, Agronomo Regional Morón, Province of Buenos Aires, Argentina. So far Victoria is grown only experimentally in the United States, but numerous economic varieties have been developed and distributed from crosses on it.

Distribution.—None.

Synonyms.—Avena Victoria, Scasso.

Fulton

Description.—Juvenile growth erect; plants very early, midtall (90 to 120 cm.); culms small to midsized, fairly stiff, slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins glabrous or ciliate on lower third; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect or slightly drooping, small to midsized, midlong, midbroad, ovate; rachises usually slightly flexuous, nodes 4 to 6; branches short to midlong, usually drooping from the middle outward, scabrous; spikelets usually few, usually 2-flowered, separating from pedicels by semiabscission or fracture; florets separating by disarticulation; glumes 24 to 30 mm. long, 6 to 8 mm. wide, 8- to 10-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas gray to reddish-yellow; first lemmas midlong to very long (17 to 22 mm.), glabrous; basal hairs few to several, short to midlong; awns common, dark-colored on lower parts, 20 to 30 mm. long, nontwisted to twisted and subgeniculate; caryopses 9 to 11 mm. long; second lemmas 12 to 17 mm. long; awns absent; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous, midlong (2.0

to 2.5 mm.). Spikelets and florets are shown in figure 57.

FIGURE 57.—Spikelets and florets of Fulton. (× 3.)

Fulton, a spring oat, may be distinguished from Fulghum by its greater uniformity of plant characters, slightly earlier maturity (4 to 5 days), hairiness near the culm nodes, and gray to reddish-yellow lemmas. It is more of an intermediate type between red and common oats than Fulghum. The lemmas are similar to those of the Markton parent. Nearly 90 percent of the second florets separate from the first florets as in common oats.

History.—Fulton (C. I. 3327, Kans. No. 6138) was originated from a cross between Fulghum and Markton oats made at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1926 by G. A. Wiebe. The F_1 plants were grown in the greenhouse at Arlington Farm, Rosslyn, Va., in the winter of 1926–27. An F_2 plant population was grown at Aberdeen in 1927 from which panicle selections were made by F. A. Coffman. Fifty of these selections were grown in 1928 by John H. Parker in the oat-breeding nursery maintained cooperatively at Manhattan, Kans., by the Kansas Agricultural Experiment Station and the United States Department of Agriculture. The most promising smut-resistant lines were selected through the F_3 to F_5 generations. After nursery yield tests were made from 1931 to 1933, seed of selection No. 303635 was turned over to H. H. Laude, of the Kansas Agricultural Experiment Station, Manhattan, for testing in plot experiments in 1934, at which time Kansas accession No. 6138 was assigned to it. It was first distributed to farmers in Kansas in 1939. Fulton was registered as an improved variety (*15, p. 30*). It was grown on 30 percent of the oat acreage of Kansas in 1942.

Distribution.—Grown to a very limited extent in Kansas, Missouri, Nebraska, and Oklahoma.

Westdale

Description.—Westdale, primarily a spring oat and somewhat intermediate between common and red oats, differs from Fulton in having slightly smaller panicles, more spikelets carrying twisted and subgeniculate awns, and a greater percentage of spikelets separating by basi-fracture as in typical red oats. Westdale has a rather stiff straw and is a slightly variable variety. It has shown some resistance to the races of stem rust found in California.

History.—Westdale (C. I. 2747) originated in Australia from a cross between Sunrise and a variety with side panicles known as Reid (*156, p. 408*). The first introduction (P. I. 80243) (*197*) of Westdale was made by the United States Department of Agriculture in 1925, when an experimental quantity of seed was received from H. Wenholz, Director of Plant Breeding, Department of Agriculture, Sydney, New South Wales. Two later introductions of Westdale were made in 1933 by the United States Department of Agriculture: (1) Westdale (W1138, P. I. 103368, C. I. 3101) (*197*) from the Wagga Experiment Farm, Bomen, New South Wales; and (2) Westdale (C. I. 3126) from the New England Experiment Farm, Glen Innis, New South Wales. Westdale (C. I. 3126) was presented to the writer by C. R. Enlow, who, while on an official trip to Australia from the United States Department of Agriculture, collected the variety as representing a forage type. Westdale was first distributed in small quantities by the California Agricultural Experiment Station at Davis in the fall of 1942.

Distribution.—Grown to a very limited extent in those sections of California in which stem rust has been a limiting factor in oat production in certain years.

Columbia

Description.—Juvenile growth erect; plants very early, midtall (90 to 120 cm.); culms small to midsized, fairly stiff, usually glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins usually glabrous; peduncles small, straight, fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, drooping; spikelets usually numerous, usually 2-flowered, separating from pedicels by fracture or semiabscission; florets separating by disarticulation; glumes 20 to 26 mm. long, 6 to 8 mm. wide, 7- to 9-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas gray to brown-

ish-gray (striped); first lemmas midlong to long (15 to 19 mm.), glabrous; basal hairs few to several, midlong; awns few to common, occasionally dark colored on lower parts, nontwisted to twisted and subgeniculate, 20 to 30 mm. long; caryopses 8 to 10 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 58.

FIGURE 58.—Spikelets and florets of Columbia. (× 1.)

Columbia, a spring oat, like Fulghum is intermediate in some characters between common and red oats. On the basis that decidedly more than 50 percent of the second florets separate from their supporting rachilla segments by disarticulation, the variety could be considered as belonging to *A. sativa* rather than to *A. byzantina*. Parts of the lemmas between the conspicuous light veins causing the characteristic stripings, mentioned by Kirkpatrick, in Columbia are brownish gray rather than gray, as in Winter Turf. It is possible to separate the two varieties from seed samples on this character.

History.—Columbia (C. I. 2820) originated as an offtype plant selection from Fulghum, made at the Missouri Agricultural Experiment Station, Columbia, Mo., by L. J. Stadler in 1920. It was subsequently tested and first distributed to farmers by that station in 1930. Stadler and Kirkpatrick (*119*) published additional notes on the history and description of Columbia. It is a registered variety (*151*, p. 24). In 1941 more than 85 percent of the oat acreage of Missouri was sown to Columbia, but it is now being replaced by disease-resistant varieties.

Distribution.—Grown in Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Missouri, Nebraska, Ohio, Oklahoma, Tennessee, Virginia, and West Virginia.

Victorgrain

Description.—Juvenile growth semiprostrate to erect; plants early, short to midtall (60 to 100 cm.); culms midsized, very stiff, glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves midwide, margins ciliate on lower third; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, small to midsized, short to midlong, midbroad, ovate; rachises usually flexuous, nodes 4 to 6; branches short to midlong, usually drooping from the middle outward, scabrous; spikelets few to numerous, 2- to 3-flowered, separating from pedicels by abscission or fracture; florets separating by disarticulation; glumes 22 to 28 mm. long, 7 to 9 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains plump; lemmas whitish-gray; first lemmas short to midlong (14 to 18 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 9 to 11 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 7 to 9 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 59.

FIGURE 59.—Spikelets and florets of Victorgrain. (× 1.)

Victorgrain, a winter to semiwinter oat, may be differentiated from similar varieties by its rather short straw, plump grains, and whitish-gray awnless lemmas. At heading time it also shows considerable bloom, similar to that of the Fulgrain parent. At time of full heading and first ripening the florets have a copperish-red appearance that is very characteristic. As it is resistant to many races of crown rust and smut and has considerable winter resistance, it is grown primarily from fall seeding. It is susceptible to Victoria blight.

History.—Victorgrain (C. I. 3092, Coker No. 30-1) was developed from the same cross between Victoria and Fulgrain from which Fulgrain Strain 4 was originated by the Coker's Pedigreed Seed Co., Hartsville, S. C. The cross was made

by the late George J. Wilds, who also supervised the selection and development of Victorgrain. It was first distributed extensively in the fall of 1940 (*40*).

Distribution.—Grown in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

Synonyms.—Victorgrain Strain 2, Victorgrain Strain 3, Victorgrain Strain 4, Victorgrain Strain 5, Victorgrain Strain 6.

Victorgrain Strain 2 (C. I. 4097) originated as a further selection from the cross between the original Fulgrain variety and Victoria. Victorgrain Strains 3 (C. I. 4238), 4 (C. I. 4314), and 5 (C. I. 4388) represent more recent selections of this type of oats distributed at successive periods by the Coker's Pedigreed Seed Co. Beginning in 1936, as in the case of the Fulgrain-type unnumbered strains, these strains were designated and released as Victorgrain 1946 Breeder Foundation Stock and Victorgrain 1947 Breeder Foundation Stock.

These various Victorgrain Strains, together with those of Fulgrain beginning with Fulgrain Strain 4, constituted the first crown rust- and smut-resistant early red oat types that became widely distributed in the South.

Ruakura

Description.—Juvenile growth semiprostrate; plants early to midseason, short to midtall (70 to 110 cm.); culms small to midsized, weak, very hairy at the nodes; sheaths dark-green, hairy; culm leaves midwide, margins ciliate; peduncles small, straight, usually fully exserted; panicles equilateral, usually erect, midsized, midlong to long, midbroad, ovate; rachises usually flexuous, nodes 5 to 7; branches midlong to long, spreading or ascending, scabrous; spikelets few to numerous, 2- to 3-flowered, separating from pedicels by semiabscission or fractures; over one-half of the florets separating by disarticulation, others by basifracture; glumes 24 to 30 mm. long, 7 to 9 mm. wide, 9- or 10-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas gray; first lemmas midlong to long (17 to 20 mm.), glabrous; basal hairs numerous, long; awns numerous, usually dark-colored on lower parts, nontwisted to twisted and geniculate, 15 to 35 mm. long; caryopses 8 to 10 mm. long; second lemmas 12 to 15 mm. long, awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous or hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 60.

FIGURE 60.—Spikelets and florets of Ruakura. (× 1¼.)

Ruakura, an intermediate to spring type, is differentiated in having branching panicles and in having decidedly hairy culms at the nodes and plumper grains. However, the separation of about 50 percent of the spikelets by semiabscission resulting in small basal cavities (some rather obscure), probably is its most outstanding differentiating character. On the basis of these characters it resembles the varieties of *A. byzantina*. Ruakura is a variable variety and is only slightly winter-hardy. When grown as a fall-sown variety at Arlington Farm, Rosslyn, Va., some segregation was evident in such characters as awning, basal hairs, color and length of lemma, and height of plant. It has some resistance to certain physiologic races of crown rust (*100, p. 22; 111*).

History.—Ruakura (C. I. 2025) was first introduced into this country by the United States Department of Agriculture in 1912 under the name "Ruakura Rust-resistant" (P. I. 33644, C. I. 701) (*197*) from the Ruakura Farm of Instruction of the New Zealand Department of Agriculture. Pridham (*127, p. 20; 129, p. 252*) and Archer (*6, p. 25*) reported on the origin of Ruakura. According to Hadfield and Calder (*67, p. 26*):

> This variety is a selection from Argentina oat made in 1908 by Mr. A. W. Green, then at the Ruakura Farm of Instruction. The original head was one of over a thousand selections made from the varieties Algerian, Argen-

tina, and Red Rust-proof with the specific object of attaining a high degree of rust-resistance. By 1914, 3,000 bushels of seed were available and sold at £1 per bushel. The name had until then been "Ruakura Rust-resistant," but owing to misunderstanding as to the difference between "rust-resistant" and "rust-proof," this was changed in 1914 to "Green's Ruakura." It proved to have far higher resistance to rust than Algerian and Red Rust-proof, and was for many years extremely popular in the North Island. Its distribution extended overseas, where its rust-resistance is well recognized and in certain places is still grown commercially. . . .

Ruakura has been of some economic importance in Australia and New Zealand.

Distribution.—Grown to a very limited extent.

Synonyms.—Green's Ruakura, Ruakura Rustproof, Ruakura Rust-resistant.

Sunrise

Description.—Juvenile growth erect; plants midseason, midtall to tall (90 to 140 cm.); culms small to midsized, fairly stiff, slightly hairy at the nodes; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins usually ciliate on lower third; peduncles small, slightly curved, fully exserted; panicles equilateral, very drooping, large, long, broad, ovate; rachises usually slightly flexuous, nodes 5 to 7; branches midlong to long, ascending or drooping from the middle outward, scabrous; spikelets few to numerous, 2- to 3-flowered, separating from pedicels by semiabscission or fracture; florets separating by disarticulation or basifracture; glumes 24 to 30 mm. long, 7 to 9 mm. wide, usually 9-veined, light-green and slightly glaucous before maturity; grains slender; lemmas brownish-gray; first lemmas midlong to long (16 to 19 mm.), glabrous; basal hairs few to several, midlong to long; awns few or absent; caryopses 8 to 10 mm. long; second lemmas 10 to 15 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 61.

Sunrise, a spring variety, may be best distinguished by its very tall and rather slender culms, very large drooping, lax panicles, and its brownish-gray lemmas. Sunrise is somewhat of an intermediate type between red and common oats, although a large percentage of the second florets separate from their rachilla segments by disarticulation or basifracture. It does have some of the characters of

FIGURE 61.—Spikelets and florets of Sunrise. (× 1¼.)

the Algerian (Red Algerian) parent, however, such as reddish straw and a small suckermouth on many lower lemmas. Because of these characters, Sunrise has been classed as belonging to *A. byzantina*. Archer (*6*) and De Villiers and Sim (*51*) classify Sunrise as belonging to *A. sativa*, but Marquand (*107, p. 38*) included it in the group which he called "*A. sterilis* ssp. *cultа*" Trabut (*A. byzantina* C. Koch) because of its closer resemblance to red oats.

History.—According to Archer (*6, p. 22*) of Australia, Sunrise (C. I. 982) is a natural crossbred by Algerian, found at Longerenong Experimental Farm, Victoria, New South Wales. As recorded by Pridham (*128*), Sunrise oats were of some interest as early as 1910. In that year at the Longerenong Agricultural College it was observed that the Algerian grown in the breeding plots showed marked variation, which indicated that natural crossing had occurred. The differences noticed were in the character of the grain and also especially in the tallness and sparse stooling of some plants. Seeds of 8 plants were grown in separate plots at Cowra, New South Wales, in 1911, and 1 of them ripened before Algerian, although sown 3 weeks later. The plants in this plot were similar with the exception of 3, 1 of which had white grain and 2 produced black grain. The predominant white-grain type was sown and bred true, and thus was grown on a larger scale and named "Sunrise" because of its early maturity.

Distribution.—Grown to a limited extent in California.

DESERT OAT

The desert oat (*Avena wiestii* Steud.) is characterized by having midtall, rather slender, and fairly stiff culms, similar to those of the wild oat (*A. fatua*). It is differentiated from the wild oat primarily

in having shorter and more slender lemmas that terminate in two bristlelike glume points. The plants are erect in juvenile growth, thus differing from the decumbent juvenile growth of the slender oat (*A. barbata* Brot.), a morphologically similar species. The desert oat has $2n=14$ chromosomes and thus is included in chromosome group I, along with the short oat (*A. brevis* Roth) and the sand oat (*A. strigosa*). Spikelets and florets of four minor species are shown in figure 62.

deserticola Malz. and *caspica* (Haussk.) Malz., are described. Malzev also described *A. wiestii* as a desert species and gave its geographical distribution as eastern Africa, Egypt, Arabia, Palestine, Syria, Mesopotamia (Iraq), and eastern Transcaucasia.

DESCRIPTION, HISTORY, AND DISTRIBUTION OF THE DESERT OAT

Description.—Juvenile growth erect; plants early to midseason, short to midtall (80 to 120 cm.); culms small, fairly

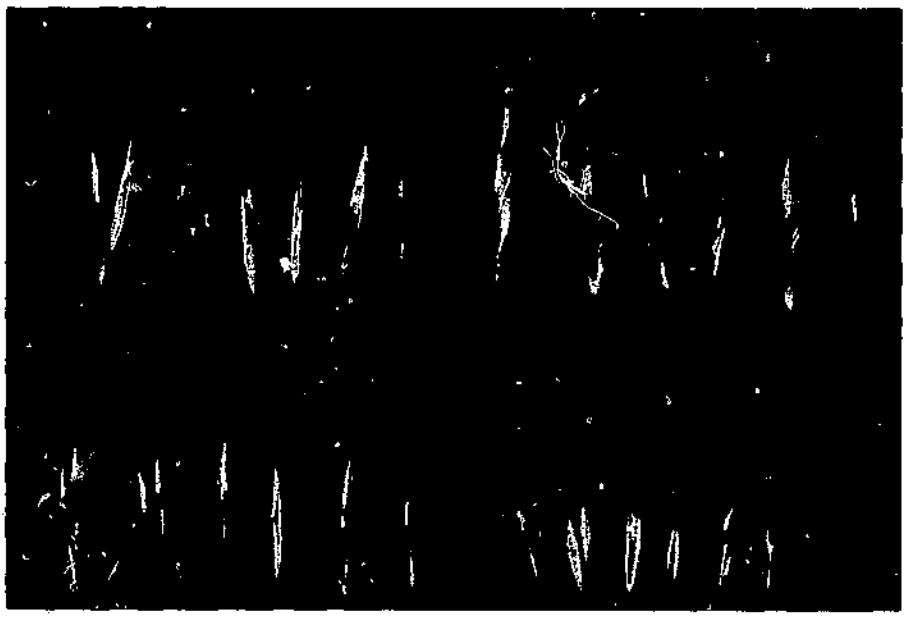


FIGURE 62.—Spikelets and florets of four minor species of oats: *A*, Desert oat (*Avena wiestii*); *B*, slender oat (*A. barbata*); *C*, sand oat (*A. strigosa*); and *D*, short oat (*A. brevis*). ($\times \frac{2}{3}$.)

Both Steudel (*177*) and Haussknecht (*71*) considered the desert oat a subspecies or variety of the slender oat, the difference in the chromosome complement then being unknown. Vavilov (*202, p. 177*) mentioned the desert oat only in connection with its susceptibility to the rust and smut organisms. Malzev (*105*) considered the desert oat a subspecies of the sand oat under which two subvarieties, namely,

stiff, glabrous at the nodes; sheaths dark-green, hairy; culm leaves midwide, margins glabrous or ciliate on lower third; peduncles small, straight, usually fully exserted; panicles equilateral, erect or slightly drooping, midsized, midlong, midbroad, ovate; rachises usually flexuous, nodes 5 to 8; branches midlong, usually very drooping, scabrous; spikelets numerous, usually 2-flowered, separating from pedicels by abscission leaving small to obscure basal scars; florets separating by disarticulation of second and third floret rachilla segments; glumes 17 to 23 mm. long, 4 to 6 mm. wide, 7- to 9-veined,

light-green and glaucous before maturity; grains very slender; lemmas grayish-brown; first lemmas short to long (14 to 19 mm.), hairy, 2-pointed (biaristate), the points 3 to 7 mm. long; basal hairs few to several, short; awns numerous, dark-colored on lower parts, twisted and geniculate, 20 to 35 mm. long; caryopses 7 to 9 mm. long; second lemmas 10 to 14 mm. long, 2-pointed (biaristate), the points 1 to 4 mm. long; awns numerous, twisted and geniculate, 15 to 30 mm. long; caryopses 6 to 8 mm. long; second floret rachilla segments slender, slightly flattened with slight cavities at upper ends, hairy (hairs long and brushlike at upper ends), long (2.5 to 3.5 mm.). Spikelets and florets are shown in figure 62, *A*.

In some spikelet and floret characters the desert oat is not greatly unlike the wild oat (*Avena fatua*); however, the basal scars are much smaller and less conspicuous to obscure, with long brushlike hairs at the upper ends of the second floret rachilla segments. It is of considerable taxonomic interest.

History.—Stanton and Dorsey (*168, pp. 811–812*) published a history and description of the only available variety of the desert oat (C. I. 1994). According to the recorded introduction of the material studied (*197*), *A. barbata wiesi*[1] (Steudel) Hausskn. (P. I. 53626) was received June 7, 1921, by the United States Department of Agriculture, seeds of which were presented by Thomas W. Brown, director of Ministry of Agriculture, Horticultural Section, Gizeh, Egypt. It was described as "an erect, sparingly hairy grass up to 2 feet in height, with linear leaves up to 7 inches long."

The geographical distribution of the desert oat already has been discussed in connection with its confusion with other species. Vavilov (*202, p. 176*) referred to the desert oat as having been collected in the province of Kirovabad (Elisabethpol), Russia.

Distribution.—None.

SLENDER OAT

The slender oat (*Avena barbata* Brot.) is characterized by having tall, small weak culms with a decumbent habit of growth that usually is evident throughout the life of the plant. The panicles are equilateral, rather large, and drooping. The spikelets separate from their supporting pedicels by abscission, the florets separating from each other by disarticulation of the rachilla segments, and the seeds falling to the ground on approaching maturity. In these characters the slender oat is similar to the wild oat (*A. fatua*). In addition to the hairiness of the lemma, the mode of spikelet and floret separation serves to distinguish it from the sand oat (*A. strigosa*). As a rule, the spikelets contain only two florets, both of which carry a long, twisted, and geniculate awn. The lemmas are long and the grains very slender; hence, the name "slender oat." The lemmas terminate in two bristlelike awn points, although these points are not so long and distinct as in the sand oat (fig. 63).

DESCRIPTION, HISTORY, AND DISTRIBUTION OF THE SLENDER OAT

Description.—Juvenile growth prostrate to semiprostrate; plants midseason to late, short to midtall (70 to 110 cm.); culms very small, weak, glabrous or slightly hairy at the nodes; sheaths dark-green, hairy; culm leaves narrow to mid-wide, margins usually ciliate; peduncles very small, weak, occasionally not fully exserted; panicles equilateral, drooping, midsized to large, midlong midbroad to broad, ovate; rachises flexuous, nodes 5 to 8; branches short to long, drooping, scabrous; spikelets numerous, 2- to 3-flowered, separating from pedicels by abscission, leaving small basal scars (suckermouths); florets separating by disarticulation of second and third floret rachilla segments; glumes 22 to 27 mm. long, 5 to 6 mm. wide, 8- to 10-veined, light-green and glaucous before maturity; grains very slender; lemmas grayish-brown; first lemmas midlong to very long (16 to 24 mm.), covered with white hairs, 2-pointed (biaristate), the points 4 to 7 mm. long; basal hairs numerous, short (not separate from hairs on lemmas); awns numerous, dark-colored on lower parts, twisted and geniculate, 30 to 40 mm. long; caryopses 6 to 9 mm. long; second lemmas 12 to 17 mm. long, 2-pointed (biaristate), the points 3 to 6 mm. long; awns numerous, 25 to 40 mm. long, twisted and geniculate; caryopses 5 to 7 mm. long; second floret rachilla segments slightly flattened, with inconspicuous cavities at upper ends, hairy, long to very long (3 to 5 mm.). Spikelets and florets are shown in figure 62, *B*.

The slender oat ripens rather late under the environment of Aberdeen, Idaho, pro-

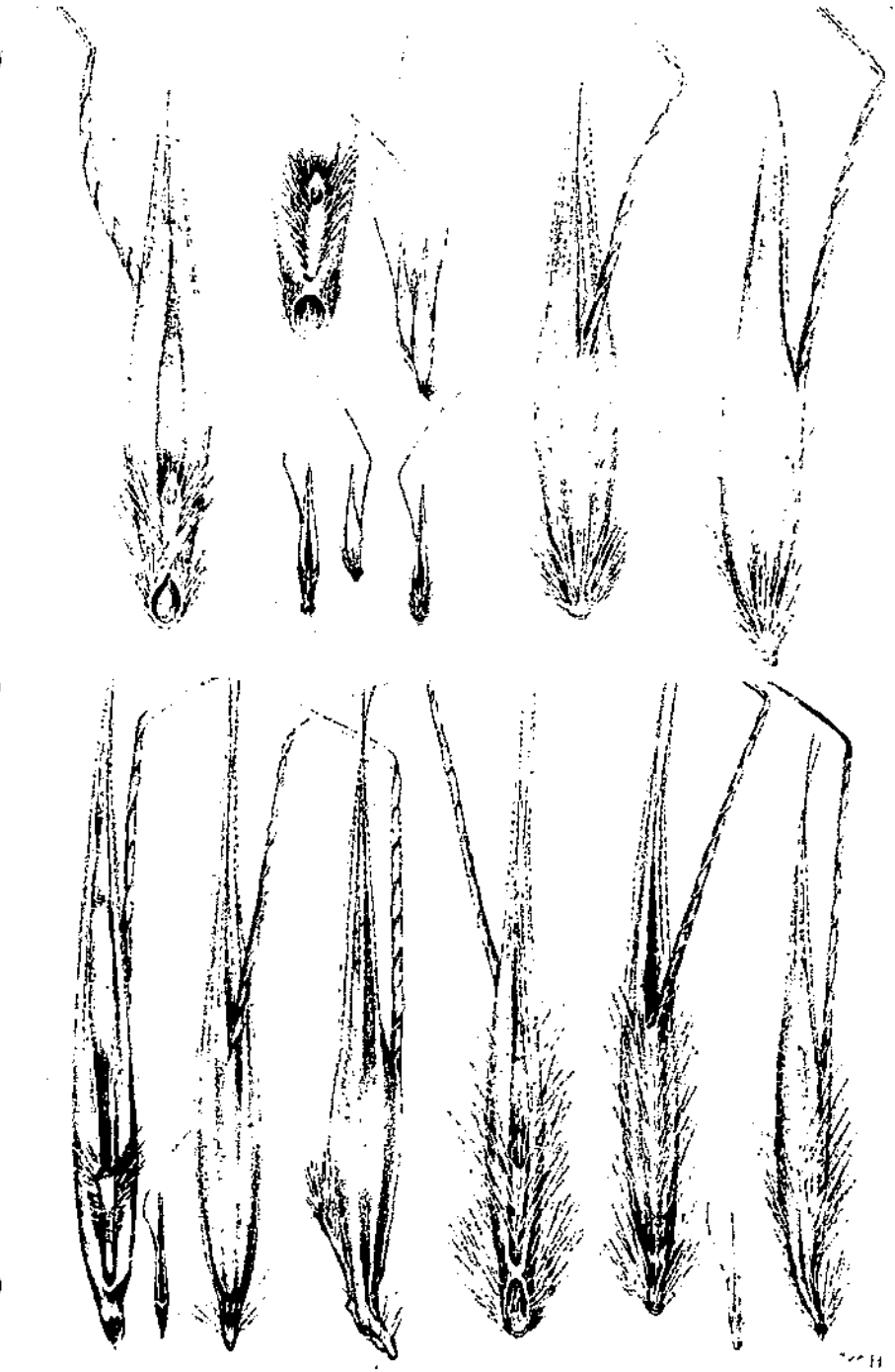


FIGURE 63.—Lemmas of three species of oats: Wild, sand, and slender. (× 4 and × 1.) (After Musil.)

ducing very slender, poorly filled, light grains that drop to the ground before becoming fully ripe. Hence, it is difficult to produce slender oat seed in quantity.

Malzev (*105, p. 488*) considered *A. barbata* as a subspecies of *A. strigosa*. However, European botanists, such as Körnicke and Werner (*93*), Schulz (*143*), and Zade (*213*), described this form under the specific name of *A. barbata*. It is considered as a distinct species here primarily because the chromosome number $2n$ equals 28. This character definitely separates the slender oat, together with the Abyssinian oat, from all other so-called minor species described in this bulletin.

History.—According to Malzev (*105, p. 495*), the slender oat is widely distributed throughout the world and is found most abundantly in the Mediterranean region of Europe and Africa. It also occurs in Palestine, Syria, Asia Minor, Persia, and Japan. Vavilov (*202*) stated that the geographical center of the origin of the slender oat is northwestern and western Europe.

The one variety of slender oat (C. I. 2466) available for this study has been described as follows (*168, p. 812*):

> . . . This oat constitutes one of the principal range grasses of California. It is not endemic to that region, but apparently was introduced from European or Asiatic sources. The material of *A. barbata* which was received by the Department of Plant Breeding at Cornell University from Dr. S. I. Zhegalov, of the Bureau of Applied Botany, Leningrad, Russia, is similar morphologically to the California plant. The plants of the latter, however, are much less pubescent, particularly in the seedling stage, than those from the Russian seed . . .

Distribution.—California.

SAND OAT

The sand oat (*Avena strigosa* Schreb.) might be better described under the name "lance oat," because of the lancelike structure of the lemma. The lanceolate lemma, which extends into two distinct points, gives it an outstanding mark of identification. The lemma of the short oat (*A. brevis*) is similarly constructed, but it is much shorter and smaller than the sand oat. The plant is rather erect in early growth habit and has rather small, midfall culms. The panicles are equilateral to semiequilateral. The spikelets usually are 2-flowered, both lemmas carrying long, twisted, and geniculate awns. The spikelets separate from their pedicels by fracture, and the florets separate from their respective rachilla segments by disarticulation, as in the common oat. The second floret rachilla segment is long and slender, which is a fairly definite mark of identification.

DESCRIPTION, HISTORY, AND DISTRIBUTION OF THE SAND OAT

Description.—Juvenile growth semiprostrate to erect; plants early to midseason, short to midtall (80 to 120 cm.); culms small, fairly stiff, glabrous at the nodes, nodes brownish; sheaths dark-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins usually glabrous; peduncles small, occasionally not fully exserted; panicles equilateral, erect or slightly drooping, small, short to midlong, narrow to midbroad, ovate; rachises usually slightly flexuous, nodes 5 to 8; branches midlong, usually drooping from the middle outward, scabrous; spikelets numerous, usually 2-flowered, separating from pedicels by fracture; florets separating by disarticulation of second and third floret rachilla segments; glumes 17 to 24 mm. long, 3 to 6 mm. wide, usually 7- to 8-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas gray; first lemmas midlong to long (16 to 20 mm.), glabrous, 2-pointed (biaristate), the points 5 to 9 mm. long; basal hairs few or absent; awns numerous, dark-colored on lower parts, twisted and geniculate, 20 to 40 mm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 15 mm. long, 2-pointed (biaristate), the point 5 to 7 mm. long; awns numerous, dark-colored on lower parts, twisted and geniculate, 15 to 30 mm. long; caryopses 5 to 7 mm. long; second floret rachilla segments very slender, glabrous (except for two opposite small tufts of short hairs at apex, giving a bifurcate appearance), long to very long (3 to 5 mm.). Spikelets and florets are shown in figures 62, *C*, and 63.

The sand oat is best distinguished by its small, slender culms; slender grains; lemmas with two long, rather conspicuous lemma points; long, slender second floret rachilla segments with short hairs at upper ends; and the type of spikelet and floret separation. It differs primarily from the Abyssinian oat in usually

having more glabrous sheaths and leaf margins, longer and more distinct lemma points, and in having less hairy second floret rachilla segments. These characters differentiate it from the desert oat (*A. wiestii*) and the common oat (*A. sativa*). There are several varieties of the sand oat that differ in color, hairiness, and size of the lemma, as well as in many minor characters.

History.—Vavilov (*202, p. 174*) discussed the occurrence of the sand oat (*A. strigosa*) as follows:

> . . . *Avena strigosa* is a wide spread weed among the cereals of White Russia, and Esthonia. As a crop it is met with on sandy soils in England and France. In the Southern provinces of the European part of Russia, in the Asiatic part of Russia in Turkestan, Bokhara, Khoresm, Persia, Afghanistan. . . The geographical area of *A. strigosa* and *A. brevis* as a crop, as well as a weed among cereals, belongs to Western Europe. Their centres of diversity gravitate towards the North-Western or Western part of Europe.

According to Stanton and Dorsey (*168, p. 810*), seeds of the sand oat (C. I. 1782) were obtained directly from the Leningrad Botanical Garden, Russia, by the United States Department of Agriculture, in 1915.

Distribution.—Grows wild in California.

Marquand (*107, pp. 6–7*) recognized three subspecies of *strigosa:* (1) *Pilosa* vars. *alba* (lemmas white) and *fusca* (lemmas gray, somewhat striped); (2) *glabrescens* vars. *albida* (lemmas yellowish-white) and *canabrica* (lemmas dark-gray, somewhat striped); and (3) *orcadensis* vars. *flava* (lemmas yellowish-white), *intermedia* (lemmas gray, somewhat striped), and *nigra* (lemmas black). Some of these forms appear to be endemic to England and have been introduced into the United States. Attempts have been made to improve some of these varieties by pure-line selection (*87, p. 25; 88*).

ABYSSINIAN OAT

The Abyssinian oat (*Avena abyssinica* Hochst.) was first described by Hochstetter (*79*), who indicated that the apex of the lemma was divided into four awn points (teeth), or bristles. By this character he differentiated it from other similar forms—the slender oat (*A. barbata*) and the sand oat (*A. strigosa*). Körnicke and Werner (*93*), Schulz (*143*), Etheridge (*61, p. 150*), and Zade (*213*) appear to have repeated Hochstetter's description, but, so far as the writer has been able to determine, it also appears that they had no specimens available for examination. Trabut (*192, 193*) and Carleton (*26, p. 103*) referred to the Abyssinian oat as being derived from the desert oat (*A. wiestii*) which is similar morphologically but not cytologically to the slender oat. Trabut (*194*) stated that the Abyssinian oat is only slightly different morphologically from the slender oat and that it is more strictly a desert species. Trabut (*195, 196*) further reported that he found under cultivation various transitional forms between the desert oat and the Abyssinian oat. He separated these forms primarily on the mode of spikelet and floret separation. Schulz (*143*) reported that the Abyssinian oat is grown in the desert region of Abyssinia and southern Arabia, where it is used primarily for forage.

The confusion as to the true identity of the so-called Abyssinian oat was not cleared up until specimens were obtained directly from Ethiopia.

DESCRIPTION, HISTORY, AND DISTRIBUTION OF THE ABYSSINIAN OAT

Description.—Juvenile growth erect; plants extremely early, very short to short (50 to 90 cm.); culms erect, small to midsized, fairly stiff, glabrous at the nodes; sheaths dark-green, very hairy; culm leaves midwide, margins ciliate; peduncles small to midsized, occasionally not fully exserted; panicles equilateral, very drooping, midsized, midlong, midbroad, ovate; rachises slightly flexuous, nodes 5 to 7; branches midlong to long, usually very drooping, scabrous; spikelets numerous, usually 2-flowered, separating from pedicels by fracture; florets separating by disarticulation of second and third floret rachilla segments; glumes 18 to 26 mm. long, 5 to 6 mm. wide, 7- to 9-veined, light-green and glaucous before maturity; grains slender; lemmas black,

gray, or white; first lemmas midlong to long (16 to 20 mm.), glabrous, 2-pointed (biaristate), the points 2 to to 4 mm. long; basal hairs few or absent; awns numerous, dark-colored on lower parts, twisted and geniculate, 20 to 30 mm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 16 mm. long, 2-pointed (biaristate), the points 2 to 3 mm. long; awns numerous, dark-colored on lower parts, twisted and geniculate, 15 to 25 mm. long; caryopses 5 to 7 mm. long; second floret rachilla segments slender, hairy (hairs usually numerous on upper half, 0.5 to 1.5 mm. long, becoming progressively longer towards the apex, plumose, and bifurcate), midlong to long (2 to 4 mm.). Spikelets and florets are shown in figure 64.

The Abyssinian oat resembles the common oat (*A. sativa*) in many plant characters and is distinct from other minor species such as the slender oat or sand oat. Strains of the introduced variety, just described, were tested for yield and quality at several experiment stations with unsatisfactory results. The plants were too short and early to compete with common oats.

History.—Vavilov (*202, p. 177*) stated:

> As an original group appear the cultivated oats and weed-oats of Abyssinia: *A. abyssinica* Hochstetter, *A. Schimperi* Körn., *A. Hildebrandti* Körn., *A. Braunii* Körn. which up to now are little explored. Dr. Emme found in these oats 28 (2X) chromosomes.

Seed of the Abyssinian oat was obtained directly from Ethiopia (Abyssinia) through the late H. V. Harlan of the United States Department of Agriculture, who collected several varieties during his plant explorations in Abyssinia in 1922.

According to Stanton and Dorsey (*168, p. 804*), Harlan contributed the following statement:

> Oats do not occupy the place in Ethiopian agriculture that analogy would define for them. Being cool weather plants their culture might be expected to center on the mountain tops. As the crop is unimportant and apparently only incidentally cultivated, the half-wild stages that Vavilov found in Asia would be expected to exist. In the limited observations I was able to make, neither expectancy is fulfilled. The high cool mountain tops are given over entirely to barley. On the secondary ridges, but still over 9,000 feet, I found oats only in two fields. It is true that there is a second harvest in

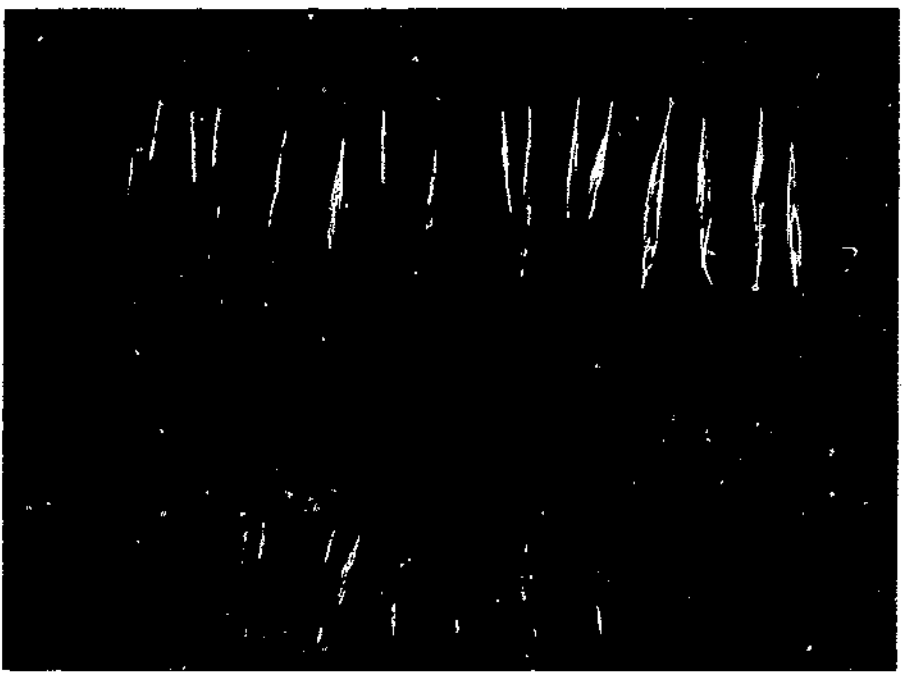


FIGURE 64.—Spikelets and florets of three varieties of the Abyssinian oat (*Avena abyssinica*) with different colored lemmas: *A*, Black, *B*, gray, and *C*, white. (× 1¼.)

July the nature of which is unknown to me, but in the principal harvest oat plants are rare at the higher elevations.

While not plentiful, oats frequently were observed in the Galla villages at about 5,000 feet elevation. There is here a possibility, of course, of racial preference. Among both Amharas and Gallas all oats occurred as mixtures in barley fields. The Galla growers told me they were seeded there intentionally, which I took to be a truthful statement, as most barley fields were free from oats. Among the Gallas oats are seeded with barley of the *deficiens* type. This sort of barley is not grown high on the mountains.

I looked carefully for wild or escaped plants of oats. I saw neither. There are two possibilities as to the status of oats. If present as a wild plant it must fruit at a different season, or it must be rare. If it does not exist in the wild state the culture of oats must be old in Ethiopian agriculture.

The unnamed varieties (C. I. Nos. 2108, 2109, 2110, 2112, and 2113), however, resembled in some characters the sand oat (*A. strigosa*) and the common oat (*A. sativa*). Cytologically, the Abyssinian oat belong to the $2n$ equals 28 chromosome group, that is, in the intermediate group or group 2, with the slender oat; whereas, the sand oat belongs to the $2n$ equals 14 chromosome group.

Among the material collected by Harlan about three distinct varieties could be differentiated; one each with black, gray, and white lemmas (fig. 64). The varieties also varied somewhat in plant height.

Distribution.—None.

SHORT OAT

The short oat (*Avena brevis* Roth) has been called the "little oat." It is very distinct and easily identified. It has been described by all oat systematists. The short oat differs mainly from the sand oat, with its awnlike points, by having a much shorter lemma with two short, coarse sawtoothlike points at the apex. The awns also are shorter and weaker, although they are usually twisted and geniculate. The panicles are small and equilateral in form. The spikelets separate from their supporting pedicels by fracture, leaving no distinct basal scars, and the florets separate from each other usually by fracture at the base of the second floret rachilla segments. These segments are rather short. The short and sand oats have the same chromosome number but differ morphologically.

DESCRIPTION, HISTORY, AND DISTRIBUTION OF THE SHORT OAT

Description.—Juvenile growth erect; plants early to midseason, very short to short (40 to 70 cm.); culms very small (slender), stiff, glabrous or hairy at the nodes, brownish; sheaths dark-green, glabrous; culm leaves narrow, margins usually glabrous; peduncles very small, straight, usually fully exserted; panicles equilateral, erect, small, short, narrow, ovate; rachises usually slightly flexuous, nodes 5 to 8; branches short, ascending or drooping, scabrous; spikelets numerous, usually 2-flowered, separating from pedicels by fracture; florets usually separating by basifracture of second floret rachilla segments; glumes 12 to 15 mm. long, 3 to 5 mm. wide, 7-veined, light-green and somewhat glaucous before maturity; grains very slender; lemmas gray; first lemmas very short (8 to 11 mm.), glabrous, terminating in sawtoothlike appendages; basal hairs few to several, very short; awns numerous, dark-colored on lower parts, twisted and geniculate, 15 to 25 mm. long; caryopses 5 to 7 mm. long; second lemmas 6 to 8 mm. long; awns numerous, dark-colored on lower parts, 8 to 15 mm. long, twisted and geniculate; caryopses 3 to 5 mm. long; second floret rachilla segments hairy at upper ends, plumose, short to midlong (1 to 2 mm.). Spikelets and florets of the short oat are shown in figure 62, *D*.

History.—The short oat (C. I. 2514) was first received by the United States Department of Agriculture from the Ducal Botanic Garden, Brunswick, Germany.

According to Vavilov (*202, p. 174*), the short oat (*A. brevis*) is unknown as a cultivated plant or as a weed in the southern parts of European and Asiatic Russia. Its occurrence in the Caucasus is doubted. Vavilov concluded that the geographical area of the short oat as a crop, as well as a weed among the small grains, is confined to western Europe. Marquand (*107, p. 7*) stated that this species is not found in Britain.

Distribution.—None.

WILD OAT

The wild oat (*Avena fatua* L.), sometimes called the common wild oat, is by far the best known and decidedly the most widely distributed of the wild species of *Avena*. It has persisted as one of the most troublesome weeds in grainfields of the north-central and western parts of the United States and Canada, and as a consequent contaminant of commercial grain. As a noxious weed, the wild oat is most difficult to eradicate because of shattering and dormancy. Numerous experiments have been conducted to develop cultural and other methods for their control with only fair success.

The wild oat is sometimes used extensively for hay in the United States, especially in California. As a byproduct of milling, wild oats are screened from spring wheat and sold in carload lots, under the trade name of "feed oats."

The wild oat differs from the desert, slender, and sand oat forms primarily by the absence of the two distinct awnlike points at the apex of the lemma. Since the common oat (*A. sativa*) also lacks these points, this species usually is regarded as having been derived from the wild oat (*A. fatua*), which has been recently refuted by Coffman (*33, p. 999*).

In the field the plants usually can be distinguished from cultivated oats by their greater vigor and whitish straw and chaff at time of maturity. The panicles are very large and drooping. The spikelets separate from their pedicels by abscission, thus leaving distinct basal scars, or suckermouths. The ring or callus resulting from the abscission layer is covered with a dense growth of hair as in *A. sterilis*. The florets separate from each other by disarticulation of their respective rachilla segments. As a result of these spikelet characters, the wild oat drops its seeds immediately on ripening. This is an outstanding mark of identification. All florets usually carry a rather long, twisted and geniculate awn. As a rule the lemmas are hairy, although some varieties or strains have been found in which the lemmas were nearly glabrous, similar to those of the tree or side oat.

DESCRIPTION, HISTORY, AND DISTRIBUTION OF THE WILD OAT

Description.—Juvenile growth erect; plants early to midseason, midtall to tall (90 to 150 cm.); culms small to midsized, stiff, glabrous; sheaths light-green, usually glabrous; culm leaves midwide to wide, margins glabrous or ciliate on lower third; peduncles small to midsized, straight, usually fully exserted; panicles equilateral, very drooping, large, long, broad, ovate; rachises usually slightly flexuous, nodes 5 to 8; branches long, ascending or drooping from the middle downward, scabrous; spikelets few to numerous, 2- to 3-flowered, separating from pedicels by abscission, leaving distinct basal scars (suckermouths); florets separating by disarticulation of the second (and third) floret rachilla segments; glumes 20 to 26 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas yellowish-white, gray, reddish-black, or black; first lemmas midlong to long (16 to 20 mm.), usually laterally hairy; basal hairs numerous, short to long; awns numerous, dark-colored on lower parts, twisted and geniculate, 25 to 40 mm. long; caryopses 9 to 12 mm. long; second lemmas 10 to 15 mm. long; awns numerous, twisted and geniculate, 20 to 30 mm. long; caryopses 6 to 9 mm. long; second floret rachilla segments sparsely hairy or hairy (usually surrounded by a ring of hairs similar to that at the base of the lower floret or spikelets), midlong to long (2 to 3 mm.). Spikelets and florets of 4 strains, or varieties, of the wild oat are shown in figure 65.

As previously stated, the wild oat (*A. fatua*) is best differentiated by its long, twisted and geniculate awns, hairy lemmas, and basal characters of the spikelets and florets (fig. 63). Great variability, especially in color and hairiness of lemmas, is found among the various col-

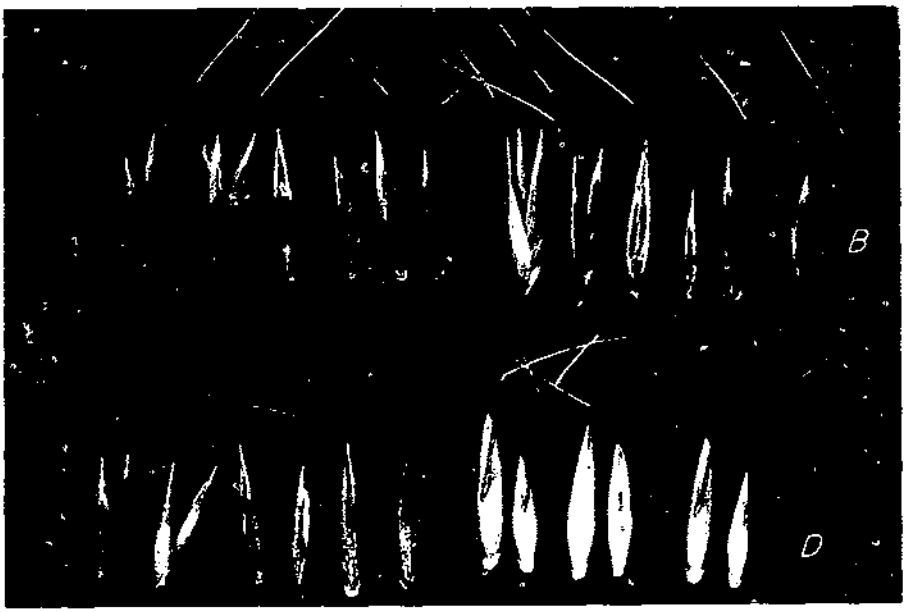


FIGURE 65.—Spikelets and florets of four strains, or varieties, of the wild oat (*Avena fatua*): *A*, Reddish black lemmas, with very short basal hairs; *B*, reddish-black lemmas, with midlong basal hairs; *C*, gray lemmas; and *D*, yellowish white lemmas, almost glabrous. (×1.)

lections of the wild oat. Sometimes intermediate, or transitional, forms are found between the wild and the common oat. One of these is *A. fatua* var. *glabrata*. However, it differs but little from the type species or variety. The lemmas of this form usually are less hairy and frequently the basal characters are less accentuated.

History.—The wild oat apparently is native of one of the older cultivated parts of Europe or Asia. It has been carried westward with the march of civilization, and is abundant in nearly all the drier grain-growing regions where oats are adapted. In the more humid regions the wild oat has not been a serious weed pest, owing perhaps to the fact that conditions are more favorable for their germination, decomposition, and consequent destruction by cultural practices and by freezing.

Vavilov (*302, p. 157*) stated that the center of origin of the wild oat is not definitely known. The assumption is that it spread to western Europe from Asia. The wide distribution of the wild oat in Turkestan, Bokhara, Afghanistan, Iran (Persia), Transcaucasia, and Armenia led Vavilov to conclude that Asia played the initial role in its origin.

Distribution.—Grows wild as a noxious weed in the western half of the United States.

COMMON OAT

The common oat (*Avena sativa* L.) includes decidedly the largest number of cultivated varieties and, therefore, is of the most economic importance. The second floret separates from the first by disarticulation of the rachilla segment, which always remains attached to the first floret. The mode of floret separation was first used by Linnaeus (*167*) to distinguish the common from the red oat and this distinction is still valid. The spikelet of *A. sativa* separates from its supporting pedicel by fracture, leaving no distinct basal scar (nekermouth) as in the varieties of *A. fatua*, *A. sterilis*, and in many of the more typical varieties of *A. byzantina* (see fig. 82).

The second floret of the spikelet of all varieties of *A. sativa* rarely, if ever, is awned; even the first floret in many varieties is awnless. Also, as a rule, basal hairs are not numer-

ous in the common oat. From an evolutionary standpoint, these more highly modified characters identify the varieties of *A. sativa* as being the most highly developed of any *Avena* species.

Although others have regarded the side oat as a separate species, the writer has adopted the classification of Vavilov (*202*), who divides the species *A. sativa* into two subspecies. Thus, in this bulletin, the common tree, or spreading, oat, is classed as *A. sativa* L. ssp. *diffusa* (Niels.) Asch. & Graeb., and the common side, or horse mane, oat as *A. sativa* L. ssp. *orientalis* Schreb.

(COMMON) TREE OAT

In the tree oat subspecies (*Avena sativa* L. ssp. *diffusa* (Niels.) Asch. & Graeb.) the panicle branches spread outward in various directions from the rachis as an axis, giving the panicle a roughly, pyramidal, treelike form; the whorls of branches usually vary from 4 to 7, although 8 have been observed.

Etheridge (*61, pp. 133–154*) recognized and identified 40 and Marquand (*107, pp. 9–27*) 58 varieties of the tree oat. This bulletin describes 146 varieties. There is a great similarity among the varieties of the tree oat and, as a consequence, they are not easily identified under all conditions. Certain agronomic and pathologic characters also must be considered as additional marks of identification.

A key to the varieties of the (common) tree oat follows:

KEY TO THE VARIETIES OF (COMMON) TREE OATS

		Page
1a. Juvenile growth (turflike) prostrate to semiprostrate, usually many tillers (winter oats).		
2a. Lower whorl of panicle branches arising at normal rachis nodes.		
3a. *Lemmas black.*		
4a. Plants early to midseason.		
Plants short to midtall (70 to 110 cm.).		
Culms very hairy at the nodes.		
Juvenile growth prostrate to semiprostrate.		
Lemmas brownish-black.		
First lemmas midlong (16 to 18 mm.), sparsely hairy laterally.		
First lemmas awns few to common, nontwisted to twisted and subgeniculate.		
Second floret rachilla segments sparsely hairy, midlong to long (2.0 to 3.0 mm.).		
Grains slender to midplump	TECH	118
4b. Plants midseason.		
Plants short to midtall (70 to 110 cm.).		
Culms glabrous at the nodes.		
Juvenile growth semiprostrate.		
Lemmas brownish-black to black.		
First lemmas midlong (16 to 18 mm.), sparsely hairy laterally.		
First lemmas awns few or absent.		
Second floret rachilla segments hairy, midlong (2.0 to 2.5 mm.).		
Grains slender to midplump	ALMERIA	119

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1a. Juvenile growth (turflike) prostrate to semiprostrate, usually many tillers (winter oats)—Con.		
4c. Plants very late.		
Plants short to midtall (70 to 120 cm.).		
Culms usually glabrous at the nodes.		
Juvenile growth prostrate.		
Lemmas brownish-black to black.		
First lemmas midlong to long (18 to 21 mm.).		
First lemmas awns numerous, twisted and geniculate.		
Second floret rachilla segments hairy, long (3.0 to 4.0 mm.).		
Grains slender	BOSWELL	119
3b. *Lemmas gray.*		
4a. Plants late.		
Plants short to midtall (70 to 120 cm.).		
Culms glabrous at the nodes.		
Juvenile growth prostrate.		
Lemmas gray (striped).		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns common to numerous, nontwisted to twisted and geniculate.		
Second floret rachilla segments glabrous or sparsely hairy, midlong to long (2 to 3 mm.).		
Grains slender	WINTER TURF	120
	PIONEER	121
	SUPPORT	121
3c. *Lemmas yellow.*		
4a. Plants midseason.		
Culms glabrous or slightly hairy at the nodes.		
Juvenile growth prostrate to semiprostrate.		
Plants short to midtall (70 to 120 cm.).		
Spikelets separating by fracture.		
First lemmas short to midlong (14 to 17 mm.).		
Lemmas yellow.		
First lemmas awns few or absent.		
Basal hairs few to several, short.		
Grains midplump	LEE	122
First lemmas midlong to long (16 to 19 mm.).		
Lemmas yellow to reddish-yellow.		
First lemmas awns numerous, strong, twisted and geniculate.		
Basal hairs few to numerous, midlong.		
Grains midplump	LETORIA	122
	LEVIC	123
Lemmas yellow.		
First lemmas awns few or absent.		
Basal hairs few or absent.		
Grains slender to midplump	STANTON	123
	LEGA	124
	LELATE	124
	LELINA	124
	LEROY	124
	MARMAC	124

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1a. Juvenile growth (turflike) prostrate to semiprostrate, usually many tillers (winter oats)—Con.		
Juvenile growth semiprostrate.		
Lemmas reddish-yellow.		
Plants short to midtall (70 to 100 cm.).		
Spikelets separating by abscission, leaving small but distinct basal scars.		
First lemmas short to midlong (14 to 17 mm.).		
First lemmas awns few or absent.		
Basal hairs numerous, short.		
Grains midplump to plump	DESOTO	125
	LENOIR	125
Plants midtall (90 to 120 cm.).		
Spikelets separating by abscission, leaving small, obscure to distinct basal scars.		
First lemmas midlong to long (17 to 20 mm.).		
First lemmas awns few or absent.		
Basal hairs several to numerous, short.		
Grains midplump	FLORILEE	125
3d. *Lemmas white.*		
4a. Plants early.		
Culms hairy at the nodes.		
Lemmas grayish-white to white.		
Paleas gray to grayish-white.		
Plants short to midtall (70 to 100 cm.).		
Panicles erect, small to midsized.		
First lemmas short to midlong (14 to 17 mm.).		
First lemmas awns few or absent.		
Grains slender to midplump	DWARF CULBERSON	126
4b. Plants early to midseason.		
Culms hairy at the nodes.		
Lemmas grayish-white to white.		
Paleas gray to grayish-white.		
Plants short to midtall (70 to 115 cm.).		
Panicles erect, small.		
First lemmas short to midlong (13 to 16 mm.).		
First lemmas awns common to numerous, twisted and geniculate, usually dark-colored on lower parts.		
Grains slender.		
Juvenile seedling plants covered with short, setaceous hairs.	HAIRY CULBERSON	127
Juvenile seedling plants not covered with short, setaceous hairs.	WINTOK	127
Plants midtall to tall (80 to 135 cm.).		
Panicles drooping, large.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns few or absent.		
Grains slender to midplump	BICKNELL	127

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1a. Juvenile growth (turflike) prostrate to semiprostrate, usually many tillers (winter oats)—Con.		
4c. Plants midseason.		
Culms hairy at the nodes.		
Lemmas grayish-white to white.		
Paleas gray to grayish-white.		
Plants midtall to tall (100 to 135 cm.).		
Panicles drooping, midsized.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns common to numerous, nontwisted to twisted and geniculate, usually dark-colored on lower parts.		
Grains slender to midplump	CULBERSON	128
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats).		
2a. Lower whorl of panicle branches occasionally arising at secondary rachis nodes.		
3a. *Lemmas black.*		
4a. Plants midseason to late.		
Plants short to tall (80 to 130 cm.).		
Panicles equilateral or semiequilateral, erect, midsized.		
Branches midlong, usually ascending, somewhat confused.		
Culms large, glabrous or slightly hairy at the nodes.		
Lemmas brownish-black to black.		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns common to numerous, nontwisted to twisted and subgeniculate.		
Grains slender to midplump	GREAT MOGUL	129
2b. Lower whorl of panicle branches arising at normal rachis nodes.		
3a. *Lemmas black.*		
4a. Plants early.		
Plants short (60 to 90 cm.).		
Panicles erect, small to midsized.		
Branches short to midlong, usually drooping.		
Culms small, hairy at the nodes.		
Lemmas brownish-black.		
First lemmas short to midlong (14 to 17 mm.), slightly hairy laterally.		
First lemmas awns common, nontwisted to twisted and geniculate, slightly glaucous.		
Second floret rachilla segments usually glabrous, midlong.		
Grains slender	EARLY JOANETTE	129
	COLBURT	130

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
Plants short to midtall (70 to 120 cm.).		
Panicles drooping, midsized.		
Branches midlong, drooping.		
Culms midsized, glabrous or slightly hairy at the nodes.		
Lemmas brownish-black to black.		
First lemmas midlong to long (16 to 20 mm.), very glaucous.		
First lemmas awns common, twisted and subgeniculate.		
Second floret rachilla segments glabrous, midlong to long.		
Grains slender	MONARCH	130
Panicles drooping, large.		
Branches long, drooping.		
Culms midsized, glabrous at the nodes.		
Lemmas dull-black.		
First lemmas midlong to long (17 to 20 mm.), slightly glaucous.		
First lemmas awns numerous, twisted and geniculate.		
Second floret rachilla segments very hairy, long.		
Grains slender	BLACK MESDAG	131
4b. Plants midseason.		
Plants short to midtall (70 to 120 cm.).		
Panicles usually erect, midsized.		
Branches long, drooping.		
Culms midsized, usually glabrous at the nodes.		
Lemmas brownish-black to black.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns few or absent.		
Second floret rachilla segments usually slightly hairy, midlong to long.		
Grains slender to midplump	BLACK DIAMOND	131
Panicles erect, large.		
Branches long, drooping.		
Culms midsized, glabrous at the nodes.		
Lemmas black.		
First lemmas midlong (16 to 18 mm.), slightly glaucous.		
First lemmas awns few or absent.		
Second floret rachilla segments sparsely hairy, midlong to long.		
Grains midplump	OLD ISLAND BLACK	132
Panicles slightly drooping.		
Branches midlong, usually ascending.		
Culms midsized, glabrous or slightly hairy at the nodes.		
Lemmas brownish-black to black.		
First lemmas long (19 to 21 mm.), slightly glaucous.		
First lemmas awns few or absent.		
Second floret rachilla segments hairy, midlong to long.		
Grains slender	NORTH FINNISH	133

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
Plants midtall to tall (90 to 140 cm.).		
Panicles drooping, midsized to large.		
Branches midlong, ascending or drooping.		
Culms midsized, sparsely hairy at the nodes.		
Lemmas brownish-black.		
First lemmas midlong (16 to 18 mm.), very glaucous.		
First lemmas awns few or absent.		
Second floret rachilla segments hairy, midlong to long.		
Grains slender	AWNLESS MONARCH.	133
	SEVNOTHREE	134
Panicles drooping, very large.		
Branches long, drooping.		
Culms very large, glabrous at the nodes.		
Lemmas brownish-black.		
First lemmas midlong to long (17 to 21 mm.), slightly glaucous.		
First lemmas awns numerous, twisted and geniculate.		
Second floret rachilla segments somewhat flattened, glabrous or sparsely hairy, long.		
Grains very plump	VICTOR	134
4c. Plants midseason to late.		
Plants short to midtall (60 to 110 cm.).		
Panicles erect, small to midsized.		
Branches short to midlong, usually drooping.		
Culms small, glabrous at the nodes.		
Lemmas brownish-black.		
First lemmas short to midlong (14 to 17 mm.), slightly glaucous.		
First lemmas awns common, nontwisted to twisted and geniculate.		
Second floret rachilla segments sparsely hairy, midlong to long.		
Grains slender	JOANETTE	134
	JOSTRAIN	135
4d. Plants late.		
Plants midtall to tall (100 to 150 cm.).		
Panicles erect, midsized.		
Branches long, ascending.		
Culms midsized to large, glabrous at the nodes.		
Lemmas brownish-black to black.		
First lemmas midlong (16 to 18 mm.), slightly glaucous.		
First lemmas awns numerous, nontwisted to twisted and geniculate.		
Second floret rachilla segments hairy, long.		
Grains midplump to plump	BLACK BELL I	135

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
3b. *Lemmas gray.*		
4a. Plants early.		
Plants short (60 to 90 cm.).		
Panicles drooping, midsized.		
Juvenile growth erect.		
Culms small, glabrous at the nodes.		
Lemmas gray (striped).		
First lemmas short to midlong (14 to 17 mm.).		
First lemmas awns numerous, twisted and geniculate.		
Grains slender	HAY	136
Juvenile growth semiprostrate to erect.		
Culms small, hairy at the nodes.		
Lemmas gray.		
First lemmas short (13 to 15 mm.).		
First lemmas awns few or absent.		
Grains midplump to plump	CAPA	136
4b. Plants midseason.		
Plants short (60 to 90 cm.).		
Panicles erect, small.		
Juvenile growth semiprostrate.		
Culms midsized, glabrous at the nodes.		
Lemmas light-gray.		
First lemmas midlong to long (17 to 21 mm.).		
First lemmas awns few or absent.		
Grains midplump	QUINCY GRAY	137
Plants midtall to tall (90 to 140 cm.).		
Lemmas gray.		
Juvenile growth erect.		
Panicles erect or slightly drooping, midsized.		
Culms small to midsized, hairy at the nodes.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns few or absent.		
Grains slender	CORNELIAN	138
Panicles drooping, large.		
Culms midsized, glabrous at the nodes.		
First lemmas midlong to long (18 to 21 mm.).		
First lemmas awns numerous, twisted and geniculate.		
Grains slender	TERRY	138
4c. Plants midseason to late.		
Plants midtall to tall (90 to 140 cm.).		
Panicles drooping, very large.		
Juvenile growth erect.		
Culms midsized to large, hairy at the nodes.		
Lemmas gray to grayish-white.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns numerous, nontwisted to twisted and geniculate.		
Grains slender	WHITE MAINE	139

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
3c. *Lemmas yellow.*		
4a. Plants early.		
Culms small to midsized, glabrous or slightly hairy at the nodes.		
Panicles small to midsized, narrow to midbroad.		
First lemmas midlong (16 to 18 mm.).		
Plants short (65 to 85 cm.).		
First lemmas awns few to common, nontwisted to twisted and subgeniculate.		
Grains slender, few or none double	Richland	139
	Hajira	140
	Osage	141
Plants short to midtall (70 to 100 cm.).		
First lemmas awns common to numerous, nontwisted to twisted and subgeniculate.		
Grains slender, few or none double	Kherson	141
	Carleton	142
First lemmas awns few or absent.		
Grains midplump, few or none double.	Iogold	142
	Edkin	143
Grains plump, some double	Boone	143
	Cedar	143
	Control	144
	Tama	144
	Vicland	144
	Vikota	144
Plants midtall (90 to 110 cm.).		
First lemmas awns few or absent.		
Grains slender	State Pride	145
	Hawkeye	145
	Iowa No. D67	145
	Iowa No. D69	145
4b. Plants early to midseason.		
Culms midsized, very hairy at the nodes.		
Panicles large, broad.		
First lemmas midlong to long (18 to 21 mm.).		
Plants short to midtall (70 to 110 cm.).		
First lemmas awns numerous, twisted and geniculate.		
Grains slender to midplump	Markton	145
	Hancock	146
	Miomark	146
	South Dakota No. 334	147
4c. Plants midseason.		
Many 3-flowered spikelets.		
Plants midtall (90 to 110 cm.).		
Grains plump.		
Culms glabrous or sparsely hairy at the nodes.		
Juvenile growth erect.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns numerous, nontwisted to twisted and subgeniculate.	Madrid	147
Culms hairy at the nodes.		
Juvenile growth semiprostrate to erect.		
First lemmas short (13 to 15 mm.).		
First lemmas awns few or absent	Aurora	147

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
Few 3-flowered spikelets.		
Culms glabrous or slightly hairy at the nodes.		
Plants short to midtall (60 to 100 cm.).		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns few to common, nontwisted to twisted and subgeniculate.		
Panicles drooping, midsized, apical branches attenuated.		
Grains midplump	MINOTA	148
Plants midtall to tall (90 to 130 cm.).		
First lemmas midlong to long (16 to 19 mm.).		
First lemmas awns few to common, twisted and geniculate.		
Panicles erect, midsized, apical branches not attenuated.		
Grains slender to midplump	AWNLESS PROBSTEIER.	148
First lemmas awns few or absent.		
Panicles very drooping, large, apical branches usually attenuated.		
Grains slender	JAPAN	149
Plants midtall to tall (90 to 140 cm.).		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns common to numerous, twisted and geniculate.		
Panicles slightly drooping, midsized, apical branches attenuated.		
Grains slender to midplump	GREEN RUSSIAN	150
	IOGREN	150
	KEYSTONE	151
	MOROTA	151
	PATTERSON	151
	RAINBOW	151
	SCHOOLMAM	151
Culms glabrous at the nodes.		
Plants midtall to tall (95 to 140 cm.).		
First lemmas short (13 to 15 mm.).		
First lemmas awns few or absent.		
Panicles erect, small to midsized.		
Grains slender to midplump	GOLDEN RAIN	151
4d. Plants late.		
Plants extremely tall (140 to 200 cm.).		
Culms glabrous at the nodes.		
First lemmas midlong to long (17 to 21 mm.).		
First lemmas awns few or absent.		
Panicles drooping, very large.		
Grains slender to midplump	TABOR	152
3d. *Lemmas white.*		
4a. Plants very early.		
Culms usually glabrous at the nodes.		
Grains very slender.		
Plants midtall (90 to 120 cm.).		
Panicles erect, small to midsized, midbroad.		
Branches spreading or ascending.		
Lemmas very white.		
First lemmas midlong to long (17 to 21 mm.).		
First lemmas awns few or absent	YAKUTSK	153

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

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1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
4b. Plants early.		
Culms glabrous or slightly hairy at the nodes.		
Grains midplump.		
Panicles erect, small to midsized, midbroad.		
Branches ascending.		
Lemmas white.		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns few or absent.		
Plants short to midtall (80 to 120 cm.).	HUDSON	153
Plants midtall (90 to 125 cm.).	AJAX	153
Grains slender.		
Plants short (60 to 90 cm.).		
Panicles erect, small, narrow.		
Branches ascending.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns few or absent.		
Lemmas white	COLE	154
First lemmas awns common, twisted and subgeniculate.		
Lemmas grayish-white	ALBION	154
Lemmas very white	WHITE CROSS	155
Plants short to midtall (70 to 100 cm.).		
Panicles erect, small, narrow.		
Branches spreading or drooping.		
Lemmas very white.		
First lemmas short to midlong (13 to 16 mm.).		
First lemmas awns common, nontwisted to twisted and subgeniculate.	EARLY CHAMPION	155
Panicles erect, small to midsized, midbroad.		
Branches drooping.		
Lemmas white.		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns few or absent.	DAUBENEY	156
	IOWA NO. 444	156
	TROJAN	157
4c. Plants early to midseason.		
Culms slightly hairy at the nodes.		
Plants short to midtall (80 to 105 cm.).		
Panicles erect, small, narrow.		
Branches ascending		
Grains midplump.		
Lemmas white.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns few or absent.	GOPHER	157
Grains slender.		
Lemmas grayish-white.		
First lemmas midlong to long (16 to 19 mm.).		
First lemmas awns common, nontwisted to twisted and geniculate, lower part of awns dark-colored.	IOWAR	157

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

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1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
4d. Plants midseason.		
Panicles very drooping, very large.		
Culms hairy at the nodes.		
Second floret rachilla segments hairy.		
Plants midtall to tall (100 to 150 cm.).		
Lemmas white.		
First lemmas midlong to long (16 to 19 mm.).		
First lemmas awns numerous, twisted and geniculate, dark-colored on lower parts.		
Grains slender	WHITE BONANZA	158
	UTON	158
Panicles slightly drooping or drooping, mid-sized to large.		
Plants light-green at time of full heading.		
Second floret rachilla segments glabrous.		
First lemmas awns few to common, nontwisted to twisted and subgeniculate.		
Culms usually glabrous at the nodes.		
Plants midtall to tall (90 to 140 cm.).		
Lemmas yellowish-white to white.		
First lemmas short (13 to 15 mm.), with depressed dorsum.		
Grains plump, many double	CANADIAN	158
First lemmas midlong (16 to 18 mm.), without depressed dorsum.		
Grains slender to midplump, few or none double	EARLY MOUNTAIN	159
Culms hairy at the nodes.		
Plants midtall (90 to 115 cm.).		
Lemmas white (ivory-white).		
First lemmas midlong to long (17 to 20 mm.).		
Grains slender to midplump	MARION	159
Second floret rachilla segments hairy.		
First lemmas awns common, nontwisted to twisted and geniculate.		
Culms slightly hairy at the nodes.		
Plants short to midtall (60 to 110 cm.).		
Lemmas reddish-yellow to white (creamy-white).		
First lemmas long (19 to 21 mm.).		
Grains slender to midplump	DANISH ISLAND	160
Plants dark-green at time of full heading.		
Lemmas white.		
Second floret rachilla segments sparsely hairy.		
First lemmas awns common, nontwisted to twisted and subgeniculate.		
Culms usually glabrous at the nodes.		
Plants short to midtall (70 to 120 cm.).		
First lemmas short (13 to 15 mm.).		
Grains slender to midplump	TOBOLSK	161

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
Second floret rachilla segments glabrous.		
First lemmas awns numerous, twisted and geniculate.		
Culms slightly hairy at the nodes.		
Plants midtall (90 to 120 cm.).		
First lemmas midlong (16 to 18 mm.).		
Grains midplump to plump.	DeWitt	161
Panicles erect, midsized to large.		
Plants dark-green at time of full heading.		
Rachises very flexuous.		
First lemmas midlong to long (16 to 20 mm.).		
Plants midtall to tall (90 to 150 cm.).		
Lemmas reddish-yellow to white (creamy-white).		
Grains slender to midplump		
Second floret rachilla segments usually glabrous.		
Culms midsized to large, hairy at the nodes.		
First lemmas awns common, nontwisted to twisted and subgeniculate.	O. A. C. No. 72	162
Second floret rachilla segments sparsely hairy.		
Culms large, glabrous or slightly hairy at the nodes.		
First lemmas awns few or absent.	O. A. C. No. 144	163
Rachises flexuous.		
Plants short to midtall (70 to 120 cm.).		
Second floret rachilla segments glabrous.		
Grains slender to midplump.		
Lemmas white.		
First lemmas midlong to long (17 to 21 mm.).		
First lemmas awns few or absent.		
Glumes widespreading at maturity.		
Basal hairs few or absent.	Scottish Chief	163
	Upright	164
First lemmas awns common, twisted and geniculate.		
Glumes not widespreading at maturity.		
Basal hairs few to several, short.	Irish Victor	164
	Maine No. 340	164
Second floret rachilla segments hairy or sparsely hairy.		
Grains very slender.		
Lemmas very white.		
First lemmas long to very long (19 to 22 mm.).		
First lemmas awns common, nontwisted to twisted and subgeniculate.		
Basal hairs common, short.	Gothland	164
	Minnesota No. 295	165

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
Panicles erect, stiff, small to midsized.		
Rachises usually slightly flexuous		
Second floret rachilla segments glabrous.		
Lemmas white.		
First lemmas short to midlong (14 to 17 mm.), with depressed dorsum.		
Plants midtall to tall (90 to 130 cm.).		
Grains very plump.		
Culms glabrous at the nodes.		
Plants very glaucous at time of full heading.		
First lemmas awns few or absent.	BELYAK	165
Culms slightly hairy at the nodes.		
Plants slightly glaucous at time of full heading.		
First lemmas awns common to numerous, twisted and subgeniculate to geniculate.	SWEDISH SELECT	165
	ABUNDANCE	167
	COLORADO NO. 37	168
	LINCOLN	168
	MIAMI	168
Second floret rachilla segments glabrous or slightly hairy.		
Plants short to midtall (70 to 100 cm.).		
First lemmas short (13 to 15 mm.), without depressed dorsum.		
Grains plump.		
First lemmas awns few to common, nontwisted to twisted and subgeniculate, not dark-colored on lower parts	OVERLAND	168
Grains slender to midplump.		
First lemmas awns numerous, twisted and subgeniculate to geniculate, dark-colored on lower parts	WAYNE	169
	LEGACY	169
Plants midtall to tall (100 to 130 cm.).		
Grains slender to midplump.		
First lemmas short to midlong (14 to 18 mm.), slight or no depressed dorsum.		
First lemmas awns common, nontwisted to twisted and subgeniculate, occasionally dark-colored on lower parts	SILVERMINE	170
	CARTIER	171
	COMEWELL	171
	EMPIRE	172
	ERBAN	172
	FORWARD	172
	IDAMINE	172
	ITHACAN	172
	LENROC	172
	MARIDA	173
	MISSION	173
	RUSOTA	173
	SPOONER	173
	STANDWELL	173
	VANGUARD	174
	WISCONSIN WONDER	174
	WOLVERINE	174
	WORTHY	174

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
4e. Plants midseason to late.		
Lemmas white.		
Panicles drooping.		
Branches spreading or slightly drooping.		
Plants tall (120 to 150 cm.).		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns few or absent.		
Grains slender to midplump	ANTHONY	174
	MINRUS	175
Panicles usually erect.		
Branches mostly ascending.		
Plants midtall to tall (90 to 140 cm.)		
First lemmas short to midlong (14 to 17 mm.).		
First lemmas awns few to common, nontwisted to twisted and subgeniculate.		
Grains midplump to plump	VICTORY	175
	BANNOCK	176
	BRIDGER	176
	EAGLE	176
	EXETER	176
	HURON	177
	STAR	177
4f. Plants very late.		
Panicles drooping.		
Branches long, ascending or drooping.		
Culms midsized to large		
Plants light-green at time of full heading		
Plants midtall to tall (90 to 140 cm.).		
Lemmas yellowish-white to white.		
First lemmas very short to short (12 to 15 mm.), with depressed dorsum.		
First lemmas awns numerous, twisted and geniculate, dark-colored on lower parts.		
Second floret rachilla segments glabrous.		
Grains plump, some double.	CASTLETON	177
Branches midlong, ascending or spreading.		
Culms small.		
Plants dark-green at time of full heading.		
Plants midtall to tall (110 to 140 cm.).		
Lemmas reddish-yellow to white (creamy-white).		
First lemmas awns very short to short (12 to 15 mm.), no depressed dorsum.		
First lemmas awns few or absent.		
Second floret rachilla segments hairy.		
Grains slender, many singles.	SANDY	178

KEY TO THE VARIETIES OF (COMMON) TREE OATS—Continued

		Page
1b. Juvenile growth (not turflike) erect, semiprostrate to erect, usually few tillers (spring oats)—Con.		
2c. Lower whorl of panicle branches arising at normal or secondary rachis nodes.		
3a. *Lemmas white.*		
Plants late.		
Culms very large.		
Grains very plump, many double.		
Lemmas yellowish-white to white.		
First lemmas midlong to long (16 to 20 mm.).		
Panicles equilateral to semiequilateral, erect, small to midsized.		
Branches ascending, confused in attitude.		
Rachises slightly flexuous.		
Plants short to midtall (60 to 110 cm.).		
First lemmas awns few to common, twisted and subgeniculate	GARTON No. 473	178
Panicles equilateral, mostly drooping, midsized to large.		
Branches spreading or ascending, not confused in attitude.		
Rachises usually very flexuous.		
Plants midtall to tall (90 to 140 cm.).		
First lemmas awns few or absent.	GARTON No. 5	179

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONOMY OF VARIETIES OF (COMMON) TREE OAT

Tech

Description.—Juvenile growth prostrate to semiprostrate; plants early to midseason, many tillers, short to midtall (70 to 110 cm.); culms midsized, stiff, very hairy at the nodes; sheaths light-green, usually glabrous; culm leaves narrow to mid-wide, margins ciliate; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachises nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, drooping, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, 8- or 9-veined, light-green and slightly glaucous before maturity; grains slender to midplump; lemmas brownish-black; first lemmas midlong (16 to 18 mm.), sparsely hairy laterally; basal hairs few to several, short; awns few to common, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 7.5 to 8.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 7.0 mm. long; second floret rachilla segments sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 66.

FIGURE 66.—Spikelets and florets of Tech. (× 1⅛.)

Tech is a rather distinct variety of winter oats that differs from Almeria in having very hairy culms near the nodes and a little longer second floret rachilla segments. It also is a very hardy winter oat.

Farmers have objected to Tech because of its black grains and, as a consequence, it has never gained commercial impor-

tance regardless of its high winter resistance and productiveness.

History.—Tech (C. I. 947) (*156; 159, pp. 13–17*) originated at Blacksburg, Va., in 1908 as a pure-line selection from the Culberson variety. The original plant selection (V. P. I. No. 1) was isolated by the late T. B. Hutcheson, of the Virginia Agricultural Experiment Station, Blacksburg, from which institution it was first distributed to farmers under the designation "Hutcheson Selection." Tech is registered as an improved variety (*170*).

Distribution.—Grown to a very limited extent in Virginia and North Carolina.

Synonyms.—Black Edgecomb, Hatchett, Hatchett Black Winter, Hutcheson Selection, V. P. I. No. 1.

Black Edgecomb apparently originated in Edgecombe County, N. C. According to the late G. M. Garren, of the North Carolina Agricultural Experiment Station, Black Edgecomb was at one time a great favorite among the farmers of that county. In the varietal survey of 1919, however, no black oats were reported from Edgecombe County.

Hatchett (C. I. 838) was originated as a selection from a commercial strain of Red Rustproof at Arlington Farm, Rosslyn, Va., by the writer in 1915. This is probably a strain of the same black oat introduced by T. W. Wood & Sons (*212*) under the name "Hatchett Black Winter." This company has been unable to give the source of the variety, but it probably was imported from England. Hatchett was distributed to a very limited extent from Arlington Farm to experiment stations and farmers in the northern part of the Winter Oat Belt in Virginia and North Carolina. Owing to the black grain, the variety never gained much commercial importance.

Tech was originally distributed under the name "Hutcheson Selection" by the Virginia Agricultural Experiment Station at Blacksburg, and is still known in some sections of the State under this name. This oat also was distributed to farmers of Virginia under the designation "V. P. I. No. 1."

Almeria

Description.—Juvenile growth semiprostrate; plants midseason, many tillers, short to midtall (70 to 110 cm.); culms midsized, stiff, glabrous at the nodes; sheaths light-green, usually glabrous; culm leaves narrow to midwide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, drooping, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, 8- or 9-veined, light-green and slightly glaucous before maturity; grains slender to midplump; lemmas brownish-black to black; first lemmas midlong (16 to 18 mm.), sparsely hairy laterally; basal hairs few to several, midlong; awns few or absent; caryopses 7.5 to 8.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 7.0 mm. long; second floret rachilla segments hairy, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 67.

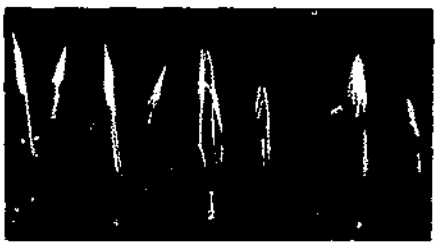

FIGURE 67.—Spikelets and florets of Almeria. (× 1½.)

Almeria, an intermediate to spring-type oat, is recognized by its brownish-black to black, midlong lemmas and somewhat prostrate habit in early growth, although it is not very winter hardy. Its hairy second floret rachilla segments and awnless lemmas also serve to further identify it.

History.—Almeria (C. I. 606) was introduced into the United States from Madrid, Spain, by the United States Department of Agriculture. It was presented by A. Ramirez, Madrid, Spain. The original lot of seed was received August 13, 1909, as an unnamed black oat (P. I. 27854) to which the name "Almeria" was later applied (*197*).

Distribution.—Grown to a very limited extent.

Synonyms.—Belgian Black Winter, "C. I. 606" of Etheridge.

Belgian Black Winter (C. I. 100) apparently was introduced from Belgium, but there evidently is no definite record of its introduction. It was distributed only to experiment stations. "C. I. 606" of Etheridge is the designation applied to this variety by Etheridge (*61, pp. 135–136*).

Boswell

Description. Juvenile growth prostrate; plants very late, many tillers,

short to midtall (70 to 120 cm.); culms small to midsized, stiff, usually glabrous at the nodes; sheaths light-green, hairy; culm leaves narrow to midwide, margins ciliate; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect or drooping, large, long, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches long, drooping, scabrous; spikelets few to numerous, usually 2-flowered, occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 28 mm. long, 6 to 8 mm. wide, 8- or 9-veined, light-green and glaucous before maturity; grains slender; lemmas brownish-black to black; first lemmas midlong to long (18 to 21 mm.), glabrous; basal hairs few to several, short; awns numerous, twisted and geniculate, 20 to 45 mm. long; caryopses 7.5 to 8.5 mm. long; second lemmas 11 to 16 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments hairy, long (3 to 4 mm.). Spikelets and florets are shown in figure 68.

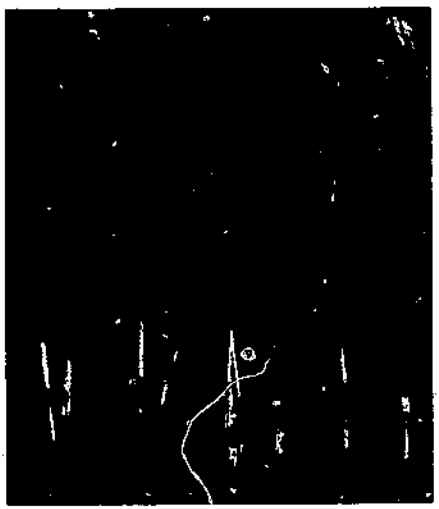

FIGURE 68.—Spikelets and florets of Boswell. (× 1½.)

Boswell is a distinct type of hardy winter oats because of its prostrate early growth habit, very late maturity, midlong to long lemmas, numerous, very long, twisted and geniculate awns, and long, hairy second floret rachilla segments.

History.—Boswell (C. I. 480) was introduced into Utah in 1905 by Stephen Boswell of Nephi, Utah, for whom the variety was named (2*4*, *pp. 26–27*). He received a small quantity of oats from a friend in England, who took the sample from a bag marked "Seed Oats" which stood on a wharf at Liverpool. It has not been possible to trace further the origin of this variety in England.

Neither Boswell nor any other winter oat variety consistently withstands the rigorous winters of central Utah. Furthermore, because of its late maturity, Boswell is unsuited to other winter oat sections of the United States.

Distribution.—Grown to a very limited extent.

Synonym.—Black Russian.

The origin of Black Russian (C. I. 610) has not been determined. It was formerly grown to a very limited extent in western Oregon and Washington, about 3,151 acres being reported from these States in the varietal survey of 1919. This small acreage has been replaced by better adapted varieties.

Winter Turf

Description.—Juvenile growth prostrate; plants late, many tillers, short to midtall (70 to 120 cm.); culms small to midsized, weak, glabrous at the nodes; sheaths light-green, hairy; culm leaves narrow, margins ciliate; peduncles midsized, straight, fully exserted; panicles equilateral, slightly drooping, midsized to large, midlong to long, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches midlong to long, spreading or ascending, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5 to 7 mm. wide, 8- or 9-veined, light-green and glaucous before maturity; grains slender; lemmas gray (striped), first lemmas midlong (16 to 18 mm.), glabrous; basal hairs few or absent; awns common to numerous, nontwisted to twisted and geniculate, 20 to 35 mm. long; caryopses 7.5 to 8.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 7.5 mm. long; second floret rachilla segments glabrous or sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 69.

Winter Turf usually is recognized by its narrow, bluish-green leaves, turflike winter habit, gray (striped) lemmas, and late maturity. It is one of the hardiest and most distinct of the older winter varieties grown in the United States for both grain and grazing. Winter Turf is weak-strawed and is highly susceptible to the rusts and smuts of oats.

History.—Winter Turf (C. I. 1570) apparently was first introduced into Vir-

FIGURE 69.—Spikelets and florets of Winter Turf. (× 1⅛.)

ginia, presumably from England, and has persisted to the present time. Details regarding its introduction and early history have not been determined. However, it has been one of the most widely grown of the common winter varieties, being reported from England, France, Spain, Belgium, and Germany. It is very probable that the variety was first brought to Virginia by early colonists.

Winter Turf was grown in Alabama, Arkansas, California, Illinois, Indiana, Kentucky, Maryland, Mississippi, North Carolina, Oregon, South Carolina, Tennessee, Virginia, and Washington. According to the varietal survey of 1919, about 314,000 acres of Winter Turf were grown. Winter Turf has been replaced by better adapted disease-resistant varieties.

Distribution.—Grown to some extent in western Oregon and Washington.

Synonyms.—Gray Winter, Grazing, Oregon Gray, Snoma, Sporen, Virginia Gray, Winter Turf Selection.

Gray Winter (C. I. 362), grown in Virginia and adjoining States; Grazing (C. I. 427), grown to some extent in Virginia for winter grazing; Oregon Gray (C. I. 673), grown in western Oregon and Washington; and Virginia Gray (C. I. 431), grown extensively in Virginia many years ago, are all strains of Winter Turf. According to the late Henry Hewett of Wheatland, Oreg., the Oregon Gray Winter strain was first grown on his farm in Oregon in 1873. The sample of seed was received from the Commissioner of Agriculture in Washington, D. C."

" Letter from the late George R. Hyslop to the late C. W. Warburton, dated April 2*6*, 1920.

Snoma (C. I. 274), a strain of Winter Turf, formerly grown to some extent in California, is now almost obsolete.

Sporen (C. I. 2506) is a standard German strain of Winter Turf that was introduced into this country by the United States Department of Agriculture in October 1938 from Albert Griesing, seedsman, Sporen, Germany. Sporen differs from the American strains of Winter Turf in having a darker, bluish-green leaf color in the seedling stage and also a slightly narrower leaf.

Winter Turf Selection (C. I. 3296), an improved strain, was selected by the late C. W. Warburton at Arlington Farm, Rosslyn, Va., in 1908 (*153*, *156*). It was distributed to a limited extent in Virginia, but it has not obtained much commercial importance.

Pioneer

Description.—Differs from Winter Turf in being a slightly hardier winter oat, in ripening 3 or 4 days later, and in growing slightly taller. The grains also are more slender, and the lemmas are of a lighter gray. Pioneer is not resistant to the rusts and smuts of oats.

History.—Pioneer (C. I. 3427) originated at the New Jersey Agricultural Experiment Station, New Brunswick, about 1935, as a selection made by H. B. Sprague from a mass population of a cross between Fulghum (winter type) and Winter Turf. The cross was made at Arlington Farm, Rosslyn, Va., in 1926, by W. D. Mankin, from where mass seed along with seed of several similar crosses was distributed from the United States Department of Agriculture to experiment stations in the more northern part of the Winter Oat Belt of the South. Pioneer was first distributed to farmers on a very limited scale in southern New Jersey in the early forties.

Distribution.—Grown to a very limited extent in New Jersey.

Support

Description.—Differs from Winter Turf in ripening several days earlier and in having a somewhat reddish straw. Support, a winter oat, is not so hardy, the grains are slightly more plump, and the lemmas more distinctly grayish-striped when grown under the western Oregon environment. It has no disease resistance. It is used as a support crop for annual viny legumes such as vetch.

History.—Support (C. I. 3180) was originated in 1926 as a plant selection known as "Number 5" from unlabeled plant material at the Oregon Agricultural Experiment Station, Corvallis, by H. A.

Schoth. It has not been possible to determine whether this selection arose from unfixed hybrid material furnished by the United States Department of Agriculture from the Arlington Farm, Rosslyn, Va., to E. N. Bressman, formerly of the Oregon Agricultural Experiment Station, in the fall of 1924 or 1925, or from stocks grown previous to 1924 at Corvallis, Oreg., by C. C. Ruth. Strain No. 5 was subsequently developed and multiplied by H. A. Schoth. Support was first distributed to farmers in western Oregon in 1931. It has been registered as an improved variety (*154, v. 27*).

Distribution.—Grown to a limited extent in western Oregon and Washington.

Lee

Description.—Juvenile growth prostrate to semiprostrate; plants midseason, many tillers, short to midtall (70 to 120 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths light-green, usually hairy; culm leaves midwide, margins ciliate; peduncles midsized, straight, fully exserted; panicles equilateral, erect or slightly drooping, midsized to large, midlong, midbroad, ovate, lower whorl of branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong to long, ascending or drooping from the middle outward, scabrous; spikelets few to numerous, usually 2-flowered, occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains midplump; lemmas yellow; first lemmas short to midlong (14 to 17 mm.), glabrous; basal hairs few to several, short; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 70.

Lee (*156*), a winter oat, is distinguished from Winter Turf in being slightly less hardy and by its earlier maturity, distinct, rather short to midlong, yellow lemmas, and midplump grains. The great vigor, high productiveness, excellent quality of grain, and stiff straw of Lee have made it an outstanding common winter variety, although it lacks resistance to the rusts and smuts. It has shown some variability in certain grain characters.

FIGURE 70.—Spikelets and florets of Lee. (× 1¼.)

History.—Lee (C. I. 2042) (*153, pp. 808–811*) originated as a selection from a cross between Winter Turf and Aurora made in 1916 by the writer at Arlington Farm, Rosslyn, Va. It was last selected in 1918. Lee is an improved registered variety (*170*).

Distribution.—Grown in Arkansas, Delaware, Illinois, Kentucky, Maryland, Missouri, New Jersey, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, and Virginia.

Synonyms.—Custis, Jackson, Lee Coldproof, Lee No. 5, Randolph.

Custis (C. I. 2041), Jackson (C. I. 2276), and Randolph (C. I. 2275) are sister varieties of Lee with similar plant and grain characters (*159, pp. 10–11*). Custis differs from Lee in growing a little taller and in having slightly longer grains. Custis has been distributed and is of some economic importance in Arkansas. Neither Jackson nor Randolph has been distributed extensively for commercial production. Lee is sold under the trade name "Lee Coldproof."

Lee No. 5 (C. I. 3755) is a reselection of Lee, developed and distributed by the North Carolina Agricultural Experiment Station. It has replaced the original Lee to some extent in North Carolina, owing to slightly greater uniformity of plant and grain characters.

Letoria

Description.—Juvenile growth prostrate to semiprostrate; plants midseason, many tillers, short to midtall (70 to 110 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths light-green, usually hairy; culm leaves midwide, margins usually ciliate; peduncles midsized, straight, fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually flexuous, nodes 5 to 7; branches midlong, spreading or ascending, scabrous; spikelets usually numerous, 2-flowered, occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 26 mm. long, 7 to 9 mm. wide, 9- to 11-veined, light-green and somewhat glaucous before maturity; grains midplump; lemmas yellow to red-

dish-yellow; first lemmas midlong to long (16 to 19 mm.), glabrous; basal hairs few to numerous, midlong; awns numerous, strong, dark-colored on lower parts, twisted and geniculate, 30 to 50 mm. long; caryopses 7 to 9 mm. long; second lemmas 12 to 15 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous or slightly hairy, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 71.

FIGURE 71.—Spikelets and florets of Letoria. (× 1.)

Letoria, a winter oat, differs from Stanton by having slightly plumper grains and numerous, strong, twisted and geniculate awns that are dark-colored on lower parts, like those of the Victoria parent. The spikelets separate from their pedicels rather consistently by fracture. Letoria is resistant to most races of crown rust and the oat smuts and is the hardiest and most productive variety originating from Lee-Victoria crosses. However, it is susceptible to mosaic that affects winter oats in the Southeastern States. This susceptibility has adversely retarded the further distribution of the variety. Letoria also is susceptible to Victoria blight, but its productiveness has not been affected when grown from fall seeding in the northern part of the Winter Oat Belt.

History.—Letoria (C. I. 3392) originated from a cross between Lee and Victoria made by the writer at Arlington Farm, Rossiyn, Va., in 1931. The development of the progeny line up to the F_5 generation is recorded (*11*, *p. 628*) as F_5 plant P–1–20. The final selection (C. I. 3392) was made in the F_8 generation in 1938. After this line proved to be outstanding for winter survival in a series of nursery tests grown at nine experiment stations in the South in the 1937–38 crop year, it was named Letoria in 1939. Letoria was further tested and increased. It was first distributed at the Piedmont Branch Station at Statesville by the North Carolina Agricultural Experiment Station in 1942. It is a product of cooperative experiments by the Idaho, Iowa, and North Carolina Agricultural Experiment Stations and the United States Department of Agriculture. Letoria is a registered variety (*154*, *v. 44*).

Distribution.—Grown to a very limited extent.

Levic

Description.—Levic differs from Letoria in growing 10 to 20 cm. taller, in ripening 3 to 4 days earlier, and in being less uniform in certain grain characters. It is less winter hardy and less resistant to the prevalent races of crown rust and the oat smuts. It is susceptible to Victoria blight and the oat mosaics.

History.—Levic (C. I. 3384) (*114*, *p. 628*), a sib of Letoria, was increased, named, and first distributed in 1941 by the Georgia Agricultural Experiment Station, Experiment, in cooperation with the United States Department of Agriculture.

Distribution.—Grown to a very limited extent.

Stanton

Description.—Juvenile growth semiprostrate; plants midseason, many tillers, short to midtall (70 to 110 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths light-green, usually slightly hairy; culm leaves midwide, margins usually ciliate; peduncles midsized, straight, fully exserted; panicles equilateral, erect, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually flexuous, nodes 5 to 7; branches midlong, spreading or ascending, scabrous; spikelets usually numerous, 2-flowered, occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 26 mm. long, 7 to 9 mm. wide, 9- to 11-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas yellow; first lemmas midlong to long (16 to 19 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 12 to 15 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 72.

Stanton, a winter oat, may be distinguished from Letoria in being less prostrate in early growth, slightly less hardy, and in having few or no awns. Like Letoria it is resistant to many races of crown rust and the oat smuts but susceptible to Victoria blight and the oat

FIGURE 72.—Spikelets and florets of Stanton. (× 1.)

mosaics. Like Letoria the yield of Stanton has not been affected by Victoria blight when grown from fall seeding in the more northern parts of the Winter Oat Belt of the South.

History.—Stanton (Strain 1) (C. I. 3855) was developed and distributed as a new disease-resistant grain and forage variety for fall seeding in the South by the Coker's Pedigreed Seed Co., Hartsville, S. C. In the fall of 1933, 1 quart of mass seed from F_3 generation plants of the Lee × Victoria cross that had been grown continuously at Arlington Farm, Rosslyn, Va., was sent by the writer to Hartsville. Thousands of heads (panicles) were selected in the F_5 and F_6 generations and planted in head rows for cold, smut, rust, and yield tests. In the spring of 1937, an outstanding strain was isolated, which was named Stanton. It was released for commercial distribution in the fall of 1941 (*40*).

Stanton Strain 2 (C. I. 4390) was first released for farm production by the Coker's Pedigreed Seed Co. in the fall of 1944 (*40, 1944*). It is a reselection of Stanton Strain 1 and is claimed to be more productive, although apparently identical in plant characters and disease reactions. Stanton Strain 3 (C. I. 4543) and Stanton Strain 4 (C. I. 4566) are further reselections of the original Stanton.

Distribution.—Grown to a limited extent in a few Southern States.

Lega

Description.—Differs from Stanton in being slightly more erect in early growth, in growing 10 to 20 cm. taller, in ripening a few days earlier, and in having some weak awns. Owing to its rapid and vigorous seedling development, Lega is suitable for fall and winter grazing in southern Georgia. Lega has the same disease reactions as Stanton. Susceptibility to Victoria blight has retarded its further distribution.

History.—Lega (C. I. 3379), a semi-winter oat, is a sib of Letoria and has the same history (*114, p. 628*). It was increased by the late R. P. Bledsoe and coworkers at the Georgia Agricultural Experiment Station, Experiment, in cooperation with the United States Department of Agriculture, and distributed to farmers in 1941.

Distribution.—Grown to a very limited extent.

Lelate

Description.—Differs from Stanton in growing 5 to 10 cm. taller and in having little shorter lemmas. Lelate, like Lega, grows slightly more erect in the seedling stage and thus is a more spring-like type than either Letoria or Stanton. It has the same disease reactions as Stanton. Susceptibility to Victoria blight has retarded its distribution.

History.—Lelate (C. I. 3391), a semi-winter oat, is a sib of Letoria and has the same origin. It was increased at the Georgia Agricultural Experiment Station, Experiment, in cooperation with the United States Department of Agriculture, and was first distributed to farmers in 1941 (*114, p. 628*).

Distribution.—Grown to a very limited extent.

Lelina

Description.—Differs from Stanton in growing a little taller and in having more slender grains. Lelina is not satisfactory, because of its lack of winter hardiness and susceptibility to Victoria blight and the mosaics of oats.

History.—Lelina (C. I. 3404), a semi-winter oat, is a sib of Letoria and has the same origin (*114, p. 628*). It was tested by the Piedmont Branch Station, Statesville, of the North Carolina Agricultural Experiment Station, in cooperation with the United States Department of Agriculture, and was first distributed in 1942.

Distribution.—Grown to a very limited extent.

Leroy

Description.—Differs from Stanton in having a more erect early growth, growing a little taller, and in ripening slightly earlier. Leroy has the same disease reactions as Stanton.

History.—Leroy (C. I. 3308), a semi-winter oat, is a sib of Letoria and has the same origin (*114, p. 630*). It was distributed from the Georgia Agricultural Experiment Station, Experiment, in 1943, in cooperation with the United States Department of Agriculture.

Distribution.—Grown to a very limited extent.

Marmac

Description.—Differs from Lega only in being more uniform in plant and grain characters. Marmac has the same disease reactions as those of Lega.

History.—Marmac (C. I. 3968), a semiwinter reselection from Lega, was isolated by S. J. Hadden and subsequently developed and distributed by the Marett Farm & Seed Co., Westminster, S. C., in the fall of 1944–45 (*106, 1945–46*).

Distribution.—Grown to a very limited extent.

DeSoto

Description.—Juvenile growth semiprostrate; plants midseason, many tillers, short to midtall (80 to 100 cm.); culms small to midsized, fairly stiff, glabrous or slightly hairy at the nodes; sheaths light-green, usually slightly hairy; culm leaves midwide, margins ciliate; peduncles small, straight, fully exserted; panicles equilateral, erect to drooping, small to midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, ascending or spreading, scabrous; spikelets numerous, usually 2-flowered, separating by abscission, leaving small, but distinct basal scars (suckermouths); florets separating by disarticulation; glumes 20 to 26 mm. long, 7 to 9 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains midplump to plump; lemmas reddish-yellow; first lemmas short to midlong (14 to 17 mm.), glabrous; basal hairs numerous, short; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 11 to 13 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 73.

FIGURE 73.—Spikelets and florets of DeSoto. (× 1⅛.)

DeSoto, a semiwinter oat, is distinguished from Lee in having shorter and finer straw, numerous short basal hairs, and a small basal cavity (suckermouth) at the base of the first lemma. DeSoto is not so hardy as Lee, Letoria, or Stanton. The mode of spikelet separation in DeSoto makes the variety somewhat intermediate in type between common and red oats. However, since the florets separate rather consistently by disarticulation of the second floret rachilla segments, DeSoto has been classified as a common oat in this study. It is resistant to most races of crown rust and the oat smuts. DeSoto has been susceptible to Victoria blight under greenhouse conditions, but when it has been grown from fall seeding in the field in Arkansas this blight has not reduced yield.

History.—DeSoto (C. I. 3923, Ark. Sel. No. X–2–25–10–1) originated from a cross between the Lee (C. I. 2042) and Victoria (C. I. 2401) oats made at Arlington Farm, Rosslyn, Va., by the writer in the spring of 1931. The F_1 and F_2 generations were grown at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1931 and 1932. The seed from about 550 F_2 plants was threshed in bulk and distributed to several experiment stations. C. Roy Adair of the Rice Branch Experiment Station, Stuttgart, Ark., selected and developed DeSoto from this F_2 material at that station. After continuous selection and testing from 1933 to 1942, the strain carried as Ark. X–2–25–10–1 proved to be one of the most promising and subsequently was named DeSoto. It was increased during the 1941–42 crop year for distribution to farmers of Arkansas in the fall of 1942. DeSoto is a registered variety resulting from cooperative experiments by the Arkansas and Idaho Agricultural Experiment Stations and the United States Department of Agriculture (*154, v. 35*).

Distribution.—Grown in Alabama, Arkansas, and Oklahoma.

Lenoir

Description.—Differs from DeSoto in growing a little taller and in having greater winter hardiness; otherwise, it has the same plant and grain characters and disease resistance. Like DeSoto, Lenoir has not been injured by Victoria blight when grown under field conditions in North Carolina.

History.—Lenoir (C. I. 3393), a sib of Letoria, was named Lenoir in 1939 (*114, p. 628*). Seed of Lenoir was distributed in only limited quantities from the Piedmont Branch Station, Statesville, of the North Carolina Agricultural Experiment Station. Lenoir was found to be inferior in yield to closely related varieties such as DeSoto, Letoria, and Stanton, and, as a consequence, further distribution of foundation seed stock was discontinued.

Distribution.—Grown to a very limited extent.

Florilee

Description.—Similar to DeSoto except for the following characters: Plants midtall (90 to 120 cm.); sheaths dark-green; spikelets 2- to 3-flowered, separating

from pedicels by abscission, leaving small, obscure to distinct basal scars (sucker-mouths); grains midplump; first lemmas midlong to long (17 to 20 mm.); basal hairs several to numerous, short. Spikelets and florets are shown in figure 74.

FIGURE 74.—Spikelets and florets of Florilee. (× 1.)

Florilee, a semiwinter to spring oat, is somewhat of an intermediate type between common and red oats in mode of spikelet separation; that is, by abscission resulting in an obscure to a rather distinct basal scar at the base of the first lemma. Like DeSoto, since a rather high percentage of the florets separate by disarticulation, Florilee is classified as a common oat. Florilee also grows a little taller than DeSoto. Florilee was distributed for growing in northern Florida, but Victoria blight attacks in 1947 and 1948 greatly reduced its value.

History.—Florilee (C. I. 4060, Quincy No. 173) was selected in 1935 from advanced plant populations of the Lee × Victoria crosses by J. H. Warner at the North Florida Experiment Station, Quincy. Florilee is a product of informal cooperative oat-breeding experiments between the Florida Agricultural Experiment Station and the United States Department of Agriculture. The Department furnished the original hybrid material and tested the reselection Quincy No. 173, later named Florilee, for resistance to smut at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1941. No smut infection occurred in any of the 77 plants that grew from smutted seed. Florilee was first distributed to farmers in the vicinity of Quincy in the fall of 1943.

A strain of Florilee type, Stanton (C. I. 4315, Coker 43-33) was distributed to agricultural experiment stations of the South in the fall of 1943 by the Coker's Pedigreed Seed Co., Hartsville, S. C., but did not appear in the company's catalog for that year. The red oat characters of Stanton (Coker 43-33), recognized by officials of that company, make it similar to Florilee and rather distinct from the established Stanton type such as Stanton (Strain 1). Stanton (Coker 43-33) is discussed in this bulletin to avoid confusion of the various Stanton strains in the literature on oat varieties. The name "Stanton," thus, should not have been applied to this offtype selection.

Distribution.—Grown to a very limited extent.

Dwarf Culberson

Description.—Juvenile growth prostrate; plants early, many tillers, short to midtall (70 to 100 cm.); culms midsized, stiff, hairy at the nodes; sheaths light-green, hairy; culm leaves midwide, margins usually ciliate; peduncles midsized, straight, fully exserted; panicles equilateral, erect, small to midsized, short to midlong, narrow to midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, ascending or drooping from the middle outward, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 25 mm. long, 6 to 8 mm. wide, 8- to 9-veined, light green and somewhat glaucous before maturity; grains slender to midplump; lemmas grayish white to white; first lemmas short to midlong (14 to 17 mm.), glabrous; paleas gray to grayish-white; basal hairs few to several, short; awns few or absent, caryopses 6.5 to 8.5 mm. long; second lemmas 10 to 12 mm. long; awns absent; caryopses 6.5 to 8.0 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 75.

FIGURE 75.—Spikelets and florets of Dwarf Culberson. (× 1.)

Dwarf Culberson, a winter oat, differs primarily from Culberson in being earlier, in having a shorter straw, and in having smaller and shorter panicles. Like the parent variety, the paleas also are grayish white.

History.—Dwarf Culberson (C. I. 748) originated as a pure line selection from Culberson made by C. A. Mooers in 1906 at the Tennessee Agricultural Experiment Station, Knoxville. It was originally designated as "Tennessee Selection K1." The name "Dwarf Culberson" was later applied to the selection

by the late C. W. Warburton because of its shorter straw as compared with the parent variety. However, it is not a true dwarf, and the name thus is somewhat misleading. Dwarf Culberson was selected for growing on fertile lowlands where taller varieties frequently lodge. Dwarf Culberson apparently was reported in the varietal survey of 1919 as Culberson, or unnamed oats.

Distribution.—Grown to a very limited extent.

Synonym.—Tennessee Selection K1.

Hairy Culberson

Description.—Juvenile growth prostrate, seedling plants frequently covered with numerous short, setaceous hairs; plants early to midseason, many tillers, short to midtall (70 to 115 cm.); culms small to midsized, fairly stiff, hairy at the nodes; sheaths dark-green, hairy; culm leaves narrow to midwide, margins ciliate; peduncles small to midsized, straight, fully exserted; panicles equilateral, erect, small, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises flexuous, nodes 5 to 7; branches short to midlong, spreading or drooping from the middle outward, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 17 to 22 mm. long, 5 to 7 mm. wide, 8- to 9-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas grayish-white to white; first lemmas short to midlong (13 to 16 mm.), glabrous, paleas gray to grayish-white; basal hairs few to several, short to midlong; awns common to numerous, usually dark-colored on lower parts, twisted and geniculate, 10 to 30 mm. long; caryopses 6 to 8 mm. long; second lemmas 8 to 12 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 76.

FIGURE 76.—Spikelets and florets of Hairy Culberson. (× 1⅛.)

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Hairy Culberson, a very hardy winter oat, is differentiated mainly by its very prostrate habit of juvenile growth, narrow to midwide leaves, early to midseason maturity, and the distinct hairiness of many of the seedling plants. The lemmas also are more slender and slightly shorter than those of the Culberson parent (*31, pp. 654–656; 33, p. 1055*).

History.—Hairy Culberson (C. I. 2505) was originated by the writer at Arlington Farm, Rosslyn, Va., as a reselection (No. 273–41–203) from a strain of Culberson selected by the late C. W. Warburton at College Park, Md., from a stock of Culberson oats received from the North Carolina Agricultural Experiment Station in 1904. The name "Hairy Culberson" was applied because of the short, fine setaceous hairs that distinguish it in the juvenile stage of growth from similar varieties (*159, p. 15*). Hairy Culberson never attained any commercial importance, but it is of taxonomic interest and plant-breeding value.

Distribution.—Grown to a very limited extent.

Wintok

Description.—Similar to Hairy Culberson except for the following characters: Juvenile growth very prostrate, juvenile (seedling) plants not covered with short, setaceous hairs (glabrous); culm leaves narrow, margins occasionally ciliate.

Wintok, a winter oat, although similar to Hairy Culberson, is differentiated from that variety primarily in having glabrous (nonhairy) juvenile plants, in being a few days earlier, in being more winter hardy, and in having slightly shorter and plumper grains. As a result of synthetic breeding, it is the hardiest variety of winter oats in existence.

History.—Wintok (C. I. 3424) was originated by the Oklahoma Agricultural Experiment Station at Stillwater, in 1932, as Oklahoma selection No. 1–32–1446, made by C. B. Cross from a mass population of a cross between Hairy Culberson and Winter Fulghum (C. I. 2500). The cross was made by W. D. Mankin at Arlington Farm, Rosslyn, Va., in 1926, from where mass seed was distributed to experiment stations of the South by the United States Department of Agriculture. Wintok was first distributed to farmers of Oklahoma about 1940. It is an improved registered variety (*154, v. 44*). In recent years the acreage of Wintok in Oklahoma has increased rather rapidly.

Distribution.—Grown in New Jersey, Oklahoma, northwestern Texas, and Virginia.

Bicknell

Description.—Juvenile growth prostrate to semiprostrate; plants early to

midseason, many tillers, midtall to tall (80 to 135 cm.); culms midsized, fairly stiff, hairy at the nodes; sheaths light-green, very hairy; culm leaves midwide to wide, margins ciliate on lower third; peduncles midsized, straight, usually fully exserted; panicles equilateral, drooping, large, long, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches long, spreading, drooping from the middle outward, scabrous; spikelets numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 6 to 8 mm. wide, 9-veined, light-green and slightly glaucous before maturity; grains slender to midplump; lemmas grayish-white to white, first lemmas midlong (16 to 18 mm.), glabrous; paleas gray; basal hairs few or absent; awns few or absent; caryopses 6.5 to 7.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 4.5 to 6.0 mm. long; second floret rachilla segments occasionally sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 77.

FIGURE 77.—Spikelets and florets of Bicknell. (× 1.)

Bicknell is distinguished from Hairy Culberson by having glabrous juvenile plants and slightly taller culms and in being more erect in early growth habit. Its lemmas are a little longer and less gray, but it has rather distinct gray paleas. Bicknell is one of the more hardy varieties of winter oats (*30*, *33*).

History.—Bicknell (C. I. 3218, Sel. 206–155) was selected by the writer at Arlington Farm, Rosslyn, Va., in 1915, from the original mass variety (C. I. 206). This oat was received from Argentina by the United States Department of Agriculture in September 1902. The sample was collected and forwarded by F. W. Bicknell, then a Presbyterian missionary to Argentina. The introduction was first distributed to experiment stations under the name "Argentina," but later it was named "Bicknell" by the late C. W. Warburton. It has not been possible to obtain further information regarding its origin in that country. Selection 206–155 is more uniform in grain and plant characters than the original oat and, hence, has been used as the type variety.

Distribution.—Grown to a very limited extent.

Synonym.—Argentina.

Culberson

Description.—Juvenile growth prostrate; plants midseason, many tillers, midtall to tall (100 to 135 cm.); culms midsized, stiff, hairy at the nodes; sheaths light-green, hairy; culm leaves midwide to wide, margins usually ciliate; peduncles midsized, straight, fully exserted; panicles equilateral, drooping midsized, midlong, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong to long, spreading, drooping from the middle outward, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 25 mm. long, 6 to 8 mm. wide, 8- to 9-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas grayish-white to white; first lemmas midlong (16 to 18 mm.), glabrous; paleas gray to grayish-white; basal hairs few to several, midlong; awns common to numerous, usually dark-colored on lower parts, nontwisted to twisted and geniculate, 15 to 35 mm. long; caryopses 7 to 9 mm. long; second lemmas 10 to 13 mm. long; awns absent; caryopses 6.5 to 8.0 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 78.

Culberson, a very hardy winter oat, is distinguished mainly by its grayish-white (dirty-white) to white lemmas and grayish-white to gray paleas, and in be-

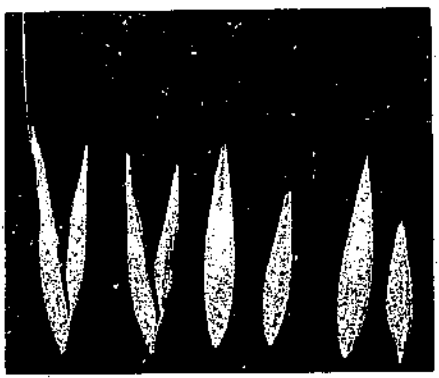

FIGURE 78.—Spikelets and florets of Culberson. (× 1¼.)

ing midseason in maturity. Commercial strains of Culberson frequently contain black oats of the Tech type, which have been referred to as Black Culberson.

History.—Culberson (C. I. 273) is said to have originated in one of the Southern States as a mass selection from Red Rustproof oats. Details regarding its origin and development have not been determined. Culberson is frequently found as an offtype in commercial Red Rustproof. Whether it originally occurred as a mutation from that variety or as a mechanical mixture is not known. Culberson formerly was grown in Arkansas, California, Kentucky, North Carolina, Tennessee, and Virginia. In the varietal survey of 1919 only 1,732 acres of this variety were reported as being grown.

Distribution.—Grown to a very limited extent.

Synonyms.—Arkansas Selection No. 20 (C. I. 3921), Black Culberson.

Great Mogul

Description.—Juvenile growth erect; plants midseason to late, short to tall (80 to 130 cm.); culms large stiff, usually glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous; culm leaves midwide to wide, margins usually glabrous; peduncles midsized, straight, occasionally not fully exserted; panicles equilateral or semiequilateral, erect, midsized, midlong, narrow, ovate, lower whorl of panicle branches occasionally arising at secondary rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, usually ascending, somewhat confused, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 28 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas brownish-black to black; first lemmas midlong to long (16 to 20 mm.), glaucous, glabrous; basal hairs few or absent; awns common to numerous, nontwisted to twisted and subgeniculate, 20 to 40 mm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments occasionally slightly hairy, long (2.5 to 3.5 mm.). Spikelets and florets are shown in figure 79.

Great Mogul, a spring oat, is distinguished from the other varieties of black spring oats by its midsized, occasionally semiside panicles, in many of which the first whorl of branches arises at a secondary rachis node, or a so-called false node, used in describing varieties of side oats. The presence of this false node is

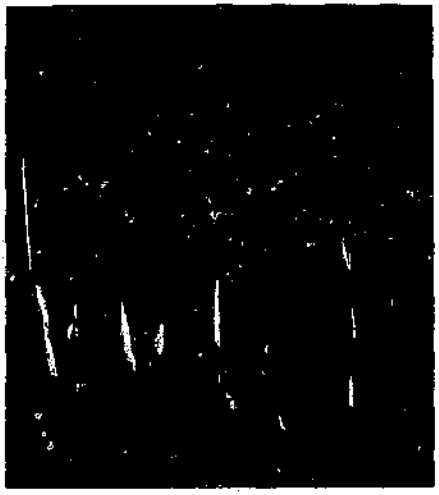

FIGURE 79.—Spikelets and florets of Great Mogul. (× 1¼.)

itself a mark of identification, although the variety is somewhat variable in many plant characters.

History.—Great Mogul (C. I. 1074) was originated in 1892 in Sweden, by Hjalmar Nilsson as a pure-line selection from Black Tartar. It was distributed to farmers in Sweden from 1901 to 1932 (*156, p. 401*). Great Mogul was first introduced into this country by the United States Department of Agriculture (P. I. 20464) and was received through Allmänna Svenska Utsädesaktiebolaget from Svalöf, Sweden, March 22, 1907 (*197*). Owing to its late maturity and black grains, Great Mogul never attained any commercial importance in the United States.

Distribution.—Grown to a very limited extent.

Synonyms.—Black Great Mogul, Black Mogul, Stormogul, Stormogulhafer I.

Early Joanette

Description.—Juvenile growth erect; plants early, short (60 to 90 cm.); culms small, fairly stiff, hairy at the nodes; sheaths light-green, usually glabrous; culm leaves narrow to midwide, margins usually ciliate; peduncles small, straight, fully exserted; panicles equilateral, erect, small to midsized, short, narrow, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 4 to 6; branches short to midlong, usually slightly drooping from the middle outward, scabrous; spikelets usually few, 2-flowered, separating by fracture; florets separating by disarticu-

lation; glumes 20 to 25 mm. long, 5 to 7 mm. wide, usually 9-veined, light-green and slightly glaucous before maturity; grains slender; lemmas brownish-black; first lemmas short to midlong (14 to 17 mm.), slightly glaucous, slightly hairy laterally; basal hairs few to several, short; awns common, dark-colored on lower parts, nontwisted to twisted and geniculate, 10 to 30 mm. long; caryopses 7 to 9 mm. long; second lemmas 10 to 13 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments usually glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 80.

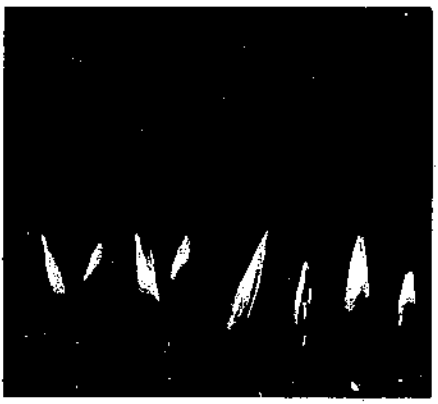

FIGURE 80.—Spikelets and florets of Early Joanette. (× 1.)

Early Joanette is a fairly distinct early black spring variety and is best differentiated from Joanette by its much earlier maturity, shorter straw, and hairy culm nodes. The few original samples collected of the variety were labeled "black oats" and named "Early Joanette."

History.—The origin of Early Joanette (C. I. 1092) has not been determined, although it probably resulted from a natural hybrid between Joanette and some early common or red variety, such as Burt. It was collected by the writer in Kansas in 1920. Early Joanette may have originated as a selection from Burt, as similar strains have been isolated from Burt (*37*).

Distribution.—Grown to a very limited extent.

Synonym. — Early Joanette Hybrid. Marquand (*107, p. 15*) described what apparently is a similar variety under the name Early Joanette Hybrid, but as far as known this out has not been grown in the United States.

Colburt

Description.—Colburt, a spring oat, differs from Early Joanette in ripening a few days later and in having more glaucous lemmas. This character helps to distinguish Colburt from the major varietal type.

History.—Colburt (C. I. 2019) originated as a pure-line selection from Burt (C. I. 203). The plant selection was made by Wilson G. Shelby at the United States Dry Land Field Station, Akron, Colo., in 1911. It subsequently was tested by the United States Department of Agriculture in cooperation with the Colorado Agricultural Experiment Station. Colburt is an improved registered variety (*170*).

Distribution.—Grown to a very limited extent in northeastern Colorado.

Monarch

Description.—Juvenile growth erect; plants early, short to midtall (70 to 110 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths light-green, usually glabrous; culm leaves midwide, margins usually glabrous; peduncles small, straight, fully exserted; panicles equilateral, usually drooping, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, drooping from the middle outward, scabrous; spikelets usually numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, usually 9-veined, light-green and very glaucous before maturity; grains slender; lemmas brownish-black to black; first lemmas midlong to long (16 to 20 mm.), very glaucous, particularly the apex ends, glabrous; basal hairs few to several, midlong; awns common, dark-colored on lower parts, twisted and subgeniculate, 20 to 35 mm. long; caryopses 7 to 10 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 81.

The chief distinguishing character of Monarch, a spring variety, is the heavy glaucousness, or waxy bloom, covering the apex end of the ripening and ripened lemmas. The grains also are slender.

History.—The origin of Monarch (C. I. 1876) has not been determined, although it is believed that the variety was brought into the Upper Mississippi Valley States many years ago by immigrants from Europe. As Monarch was simply

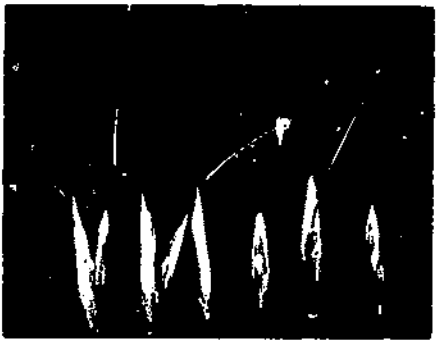

FIGURE 81.—Spikelets and florets of Monarch. (× 1.)

reported as black oats in Indiana, Illinois, Missouri, and New York and was classed as an unnamed variety in the survey of 1919, the extent of its distribution at that time could not be determined. A large percentage of a relatively small number of samples received from farmers reporting black oats in these States was identified as Monarch or a closely allied variety.

Distribution.—Grown to a very limited extent.

Synonyms.—Suwannee, Blackhull.

Suwannee (C. I. 4797), grown to a very limited extent in Florida and of undetermined origin, may differ in adaptation from the type variety Monarch. Blackhull is merely another name for Suwannee.

Black Mesdag

Description.—Juvenile growth erect, plants early, short to midtall (70 to 120 cm.); culms midsized, fairly stiff, usually glabrous at the nodes; sheaths dark-green, usually glabrous; culm leaves midwide to wide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles equilateral, drooping, large, very long, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches long, drooping from the middle outward, scabrous; spikelets numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 23 to 27 mm. long, 5.5 to 7.5 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas dull black; first lemmas midlong to long (17 to 20 mm.), slightly glaucous, glabrous; basal hairs several to numerous, midlong; awns numerous, dark-colored on lower parts, twisted and geniculate, 35 to 40 mm. long; caryopses 6.5 to 8.0 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 4.5 to 6.5 mm. long; second floret rachilla segments very hairy, long (3.0 to 3.5 mm.). Spikelets and florets are shown in figure 82.

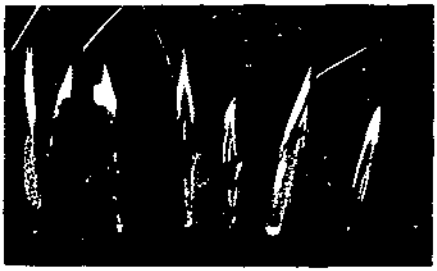

FIGURE 82.—Spikelets and florets of Black Mesdag. (× 1½.)

Black Mesdag, a spring oat, is recognized by its early maturity, large, drooping panicles, numerous twisted and geniculate awns, and dull-black lemmas with very hairy second floret rachilla segments. It is resistant to many physiologic races of the oat smuts and has been used as a smut-resistant parent in hybrids.

History.—Black Mesdag (C. I. 1877) was introduced into the United States from Vilmorin-Andrieux et Cie, Paris, France. It was selected by Louis de Vilmorin from Black President, a variety that this company obtained from the Netherlands, into which country it was introduced about 1870 from the Baltic Provinces. Stocks of this variety have been received also from the Swedish Plant Breeding Station, Svalöf, Sweden.

Distribution.—Grown to a very limited extent.

Synonyms.—Black President, Improved Black President, President.

Black President is the variety from which Black Mesdag was selected. Marquand (*107, p. 14*) described what was apparently a strain of Black Mesdag under the name "President." Improved Black President appears to be a selection from the original Black President. These synonymous strains have been of little economic value in the United States.

Black Diamond

Description.—Juvenile growth semiprostrate to erect; plants midseason, short to midtall (70 to 120 cm.); culms midsized, stiff, usually glabrous at the nodes; sheaths dark-green, glabrous, very glaucous before maturity; culm leaves narrow to midwide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles

equilateral, usually erect, midsized, long, midbroad to broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches long, drooping from the middle outward, scabrous; spikelets numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas brownish-black to black; first lemmas midlong (16 to 18 mm.), slightly glaucous, sparsely hairy laterally; basal hairs few to several, short; awns few or absent; caryopses 6.5 to 8.0 mm. long; second lemmas 11 to 14 mm. long; awns absent; second floret rachilla segments usually slightly hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 83.

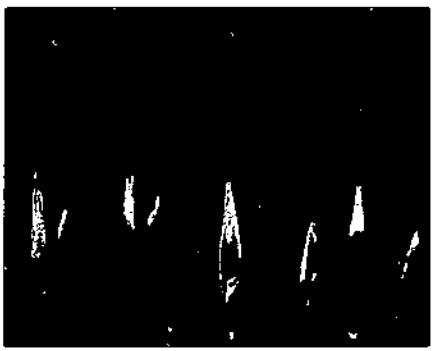

FIGURE 83.—Spikelets and florets of Black Diamond. (× 1⅛.)

Black Diamond, a spring oat, although rather semiprostrate in early growth, differs from the other awnless varieties of this group in having a few hairs on the lateral sides of the lemmas. Under some conditions, these hairs may not be present on all lemmas, but they appear to be a fairly constant character and afford a reliable mark of identification.

History.—The origin of Black Diamond (C. I. 1878) is undetermined. The sample of seed used in these studies was received from the Missouri Agricultural Experiment Station. Black Diamond formerly was grown to a limited extent simply as black oats in the Midwestern States.

Distribution.—Grown to a very limited extent.

Old Island Black

Description.—Juvenile growth erect; plants midseason, short to midtall (70 to 120 cm.); culms midsized, stiff, glabrous at the nodes; sheaths light-green, glabrous or slightly hairy; culm leaves midwide, margins glabrous or slightly ciliate; peduncles small, straight, fully exserted; panicles equilateral, erect, large, long, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches long, drooping from the middle outward, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, 8- or 9-veined, light-green and glaucous before maturity; grains midplump; lemmas black; first lemmas midlong (16 to 18 mm.), slightly glaucous, glabrous, or occasionally sparsely hairy laterally; basal hairs few to several, short; awns few or absent; caryopses 7.0 to 8.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 4.5 to 6.0 mm. long; second floret rachilla segments sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 84.

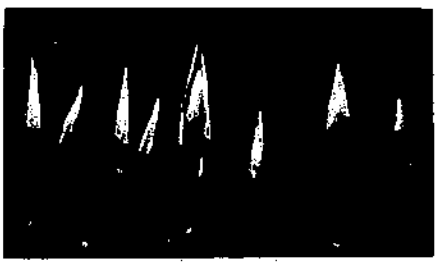

FIGURE 84.—Spikelets and florets of Old Island Black. (× 1¼.)

Old Island Black is recognized by its very large, spreading panicles, midlong, midplump, thin-hulled grain, almost complete absence of awns, and sparsely hairy second floret rachilla segments. It is an exceedingly uniform variety of spring oats in all characters.

History.—Old Island Black (C. I. 1756) presumably was introduced into the United States many years ago from Prince Edward Island or one of the other maritime provinces of Canada, where it is of some economic importance. Typical specimens of the variety have been received from that country with the information that the variety has been grown there for many years.

Distribution.—Grown to a very limited extent.

Synonym.—Prince Edward Island (C. I. 2035).

"Prince Edward Island" is the name used for a strain of this variety that ap-

parently was originally imported into the United States from that island.

North Finnish

Description.—Juvenile growth erect; plants midseason, short to midtall (70 to 120 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, usually glabrous; culm leaves midwide, margins usually glabrous; peduncles small to midsized, straight, fully exserted; panicles equilateral, slightly drooping, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches midlong, usually ascending, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 28 mm. long, 5.5 to 7.5 mm. wide, usually 9- or 10-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas brownish-black to black; first lemmas long (19 to 21 mm.), slightly glaucous, glabrous; basal hairs few or absent; awns few or absent; caryopses 8 to 10 mm. long; second lemmas 11 to 16 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 85.

FIGURE 85.—Spikelets and florets of North Finnish. (× 1⅛.)

North Finnish, a spring oat, is distinguished from Old Island Black by its longer and more slender lemmas and hairy second floret rachilla segments.

History.—North Finnish (C. I. 1882) apparently was first introduced into North America from northern Finland, where black oats of this type are grown. Samples of black oats received from farmers from Indiana, Illinois, Missouri, and Alaska contained the North Finnish variety as an admixture.

Distribution.—Grown to a very limited extent.

Awnless Monarch

Description.—Juvenile growth erect; plants midseason, midtall to tall (90 to 140 cm.); culms midsized, stiff, sparsely hairy at the nodes; sheaths dark-green, usually glabrous; culm leaves narrow to midwide, margins glabrous or slightly ciliate on lower third; peduncles small to midsized, straight, fully exserted; panicles equilateral, drooping, midsized to large, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches midlong, ascending or drooping from the middle outward, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 22 mm. long, 5 to 7 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains slender; lemmas brownish-black; first lemmas midlong (15 to 18 mm.), very glaucous, particularly at apex ends, glabrous; basal hairs few or absent; awns few or absent; caryopses 6.0 to 8.5 mm. long; second lemmas 10 to 14 mm. long, glabrous; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 86.

FIGURE 86.—Spikelets and florets of Awnless Monarch. (× 1⅛.)

Awnless Monarch, a spring oat, differs primarily from Monarch in having few or no awns and hairy second floret rachilla segments. It also usually grows a little taller than Monarch. The lemmas, like those of Monarch, are very glaucous; that is, covered with a white, waxy bloom, giving the variety a rather distinct mark of identification.

History.—Etheridge (*61, p. 141*) described Awnless Monarch (C. I. 1870) under the name of Monarch Selection. He selected it from Monarch during the course of his classification studies. At one time it was grown as an unnamed black oat on a few farms in Illinois, Indiana, and Missouri.

Distribution.—Grown to a very limited extent.

Synonym.—"Monarch Selection" of Etheridge.

Sevnothree

Description.—Differs from Monarch Selection in having plants that grow a little shorter and in having resistance to certain races of stem rust. Sevnothree, a spring oat, is of no commercial importance, but it has been used as a rust tester in physiologic race studies of the oat rusts.

History.—Sevnothree (C. I. 3251), according to M. N. Levine [15] of the United States Department of Agriculture and the University of Minnesota, originated from a pure-line selection made by Dixon L. Bailey from an oat population of Monarch Selection (C. I. 1879), described by W. C. Etheridge. Sevnothree was used by E. C. Stakman, M. N. Levine, and D. L. Bailey in their original investigations on the physiologic race specialization of oat stem rust. It was originally grown as Monarch Selection until investigation of additional lots of Monarch Selection seed, collected from different sources, revealed that the plants grown from these lots were, in general, entirely susceptible to the various physiologic races tested. Resistant plants of the original seed sample were, therefore, selected as the basis for obtaining a pure-line differential host. This line until recently has been designated as Strain 703, after the nursery row number at University Farm, St. Paul, Minn., from which the original seed stock came.

Distribution.—None.

Victor

Description.—Juvenile growth semiprostrate to erect; plants midseason, midtall to tall (90 to 140 cm.); culms very large, stiff, glabrous at the nodes; sheaths dark-green, usually glabrous; culm leaves wide, margins usually ciliate on lower third; peduncles large, straight, occasionally not fully exserted; panicles equilateral, drooping, very large, very long, very broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually flexuous, nodes 5 to 7; branches long, drooping from the middle outward, scabrous; spikelets numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 30 mm. long, 7 to 10 mm. wide, 9- to 11-veined, light-green and somewhat glaucous before maturity; grains very plump; lemmas brownish-black; first lemmas midlong to long (17 to 21 mm.), slightly glaucous, glabrous; basal hairs few to several, long; awns numerous, dark-colored on lower parts, twisted and geniculate, 25 to 45 mm. long; caryopses 7 to 9 mm. long; second lemmas 10 to 13 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments somewhat flattened, glabrous or sparsely hairy, long (2.5 to 3.5 mm.). Spikelets and florets are shown in figure 87.

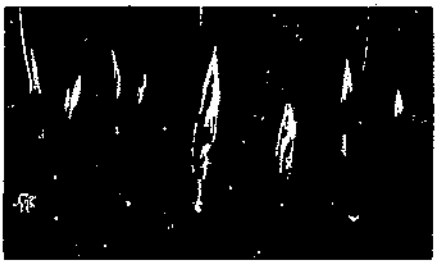

FIGURE 87.—Spikelets and florets of Victor. (× 1.)

The plant and grain characters of Victor are outstanding. Its very large culms, very large panicles, plump grains, and large, thick-hulled awned lemmas easily distinguish it from other varieties of black oats with the tree type of panicles. Victor is an intermediate to spring type with a small degree of winter hardiness.

History.—Victor (C. I. 803) is a cross-bred production of Garton's Limited of Warrington, England. The parent varieties involved in its breeding are said to be Abundance, Black Tartar, Goldfinder, and Winter Turf. In the varietal survey of 1919, only 4,870 acres of Victor oats were reported as being grown.

Distribution.—Grown to a limited extent.

Synonyms.—Bountiful, Garton No. 306, Garton No. 396, Garton No. 453, Garton No. 1174.

These are all English names of strains of the Victor type that were produced and distributed by the Garton's Ltd., Warrington, England. They are of little value in the United States.

Joanette

Description.—Juvenile growth semiprostrate to erect; plants midseason to late, short to midtall (60 to 110 cm.); culms small, fairly stiff, glabrous at the nodes; sheaths light-green, usually glabrous; culm leaves narrow to midwide, margins usually glabrous; peduncles small, straight, fully exserted; panicles equilateral, erect, small to midsized, short, narrow, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 4 to 6; branches short to midlong,

[15] Letter from M. N. Levine, St. Paul, Minn., dated October 4, 1935.

usually drooping from the middle outward, scabrous; topmost spikelets of panicles occasionally multiflorous; spikelets usually few, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 25 mm. long, 5 to 7 mm. wide, usually 9-veined, light-green and slightly glaucous before maturity; grains slender; lemmas brownish-black; first lemma short to midlong (14 to 17 mm.), slightly glaucous, occasionally slightly hairy laterally; basal hairs few to several, midlong; awns common, dark-colored on lower parts, nontwisted to twisted and geniculate, 10 to 30 mm. long; caryopses 7 to 9 mm. long; second lemmas 10 to 13 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments sparsely hairy, midlong to long (2 to 3 mm.). Spikelet and florets are shown in figure 88.

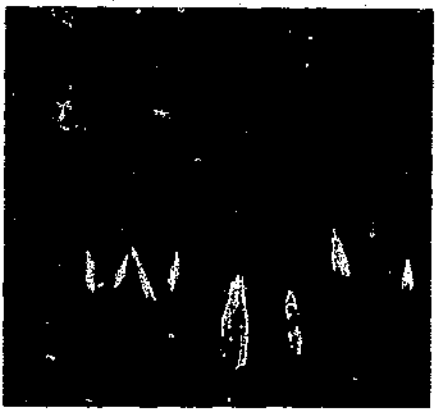

FIGURE 88.—Spikelets and florets of Joanette. (× 1⅛.)

Joanette, a spring oat, is distinct in having a rather short straw and in being late in maturity. Its semiprostrate habit in early growth also differentiates it from other similar varieties. Joanette is not winter-hardy, however. Under some conditions, an occasional top spikelet of the panicle will be multiflorous, that is, showing a tendency toward the hull-less type.

History.—Joanette (C. I. 1880) was probably first introduced into the United States from Canada, although it may have been imported earlier directly from France. The late C. A. Zavitz,[16] of the Ontario Agricultural College at Guelph, Canada, has furnished the following statement on its introduction into Canada: "The Joanette variety of black oats was imported by this institution from France in the winter of 1888–89. I was in the department here at that time and I believe this variety was not grown in Canada previous to that date." In the varietal survey of 1919, Joanette apparently was reported as black oats.

Distribution.—Grown to a very limited extent.

Jostrain

Description.—Differs from Joanette in being a little earlier and in having moderate resistance to certain races of stem rust. Jostrain is of no agronomic importance, but it is useful as a differential host for specific physiologic races of stem rust and as a parent in certain hybrids.

History.—Jostrain (C. I. 2660), a spring oat, originally known as Joanette Strain, was selected from Joanette by W. L. Gordon of the Dominion Laboratory of Plant Pathology, Winnipeg, Manitoba, Canada, in 1919.

Distribution.—None.

Black Bell I

Description.—Juvenile growth erect; plants late, midtall to tall (100 to 150 cm.); culms midsized to large, stiff, glabrous at the nodes; sheaths light-green, usually glabrous; culm leaves midwide to wide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, midsized, midlong, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually flexuous, nodes 5 to 7; branches long, ascending, scabrous; spikelets few to numerous, mostly 2-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 28 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and somewhat glaucous before maturity; grains midplump to plump; lemmas brownish-black to black; first lemmas midlong (16 to 18 mm.), slightly glaucous, glabrous; basal hairs few to several, short; awns numerous, dark-colored on lower parts, nontwisted to twisted and geniculate, 15 to 35 cm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments hairy, long (2.5 to 3 mm.). Spikelets and florets are shown in figure 89.

Black Bell I, a spring variety, differs from Black Mogul in having distinct branching panicles without any indication of the so-called false nodes. This variety also ripens a few days earlier, has slightly less coarse straw, and grows a little taller than Black Mogul. Black

[16] Letter from C. A. Zavitz, dated November 13, 1923.

FIGURE 89.—Spikelets and florets of Black Bell I. (× 1⅛.)

Bell I also is a more uniform variety in most grain characters.

History.—Black Bell I (C. I. 1767) was developed at the Swedish Plant Breeding Station, Svalöf, Sweden, as a pure-line selection from the old Swedish black oat, which was imported into the United States under the name "Black Norway." Black Bell I was introduced into this country from Svalöf as Svalöf's Svarta Klockhafre, by the United States Department of Agriculture (P. I. 20463) (*197*). It was received through Allmänna Svenska Utsädesaktiebolaget from Svalöf, Sweden, March 22, 1907.

Distribution.—Grown to a very limited extent.

Synonyms.—Black Bell II, Black Norway, Svalöf's Svarta Klockhafre. Black Norway (C. I. 1874) is a strain of Swedish black oats similar to Black Bell I, described by Etheridge (*61, p. 137*). It was formerly grown to some extent in the United States, but it is now almost obsolete. Black Bell II (C. I. 1308) is closely related to Black Bell I.

Hay

Description.—Juvenile growth erect; plants early, short (60 to 90 cm.); culms small, weak, glabrous at the nodes, sheaths light-green, glabrous; culm leaves narrow, margins glabrous or slightly ciliate; peduncles small, straight, fully exserted; panicles equilateral, drooping, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches short to midlong, drooping from the middle outward, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 24 mm. long, 5 to 7 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains slender; lemmas gray (striped); first lemmas short to midlong (14 to 17 mm.), glabrous; paleas grayish-white; basal hairs several, midlong; awns numerous, dark-colored on lower parts, twisted and geniculate, 15 to 35 mm. long; caryopses 6.5 to 8.0 mm. long; second lemmas 10 to 13 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 90.

FIGURE 90.—Spikelets and florets of Hay. (× 1⅛.)

Hay, a spring oat, is differentiated mainly by its early maturity, rather fine straw, slender grains, small, gray (striped) lemmas with several basal hairs.

History.—The origin of Hay (C. I. 1622) is undetermined. The original sample of seed used in this study was obtained from Kansas in 1912 by the United States Department of Agriculture, but no information is available regarding its origin in Kansas.

Distribution.—Grown to a very limited extent.

Capa

Description.—Juvenile growth semiprostrate to erect; plants early, short (60 to 90 cm.); culms small, weak, hairy at the nodes; sheaths light-green, glabrous; culm leaves narrow, margins glabrous or slightly ciliate; peduncles small, straight, fully exserted; panicles equilateral, drooping, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches short to midlong, drooping from the middle outward; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 6 to 7 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains midplump to plump; lemmas

gray; first lemmas short (13 to 15 mm.), glabrous; paleas brown; basal hairs few or absent; awns few or absent; caryopses 6 to 8 mm. long; second lemmas 9 to 12 mm. long; awns absent; caryopses 5 to 6 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 91.

FIGURE 91.—Spikelets and florets of Capa. (× 1¼.)

Capa, an intermediate to spring oat, differs from Hay in being more prostrate in early growth, although not winterhardy. The culms are slightly larger and hairy at the nodes, the grains are shorter and plumper, and the paleas are brown rather than grayish-white. The second floret rachilla segments are glabrous rather than sparsely hairy. The second lemmas of the spikelets usually are more decidedly grayish than the first lemmas. Capa has shown resistance to certain physiologic races of crown rust.

History.—Seed of Capa (C. I. 2765) (*173, p. 678*) under the designation "*Avena* Capa" was forwarded directly to the plant pathology section, Iowa Agricultural Experiment Station, Ames, in April 1929, by Jose M. Scasso, Agronomo Regional, Morón, Province of Buenos Aires, Argentina. Another lot of seed, Capa (C. I. 2860) was received from the same source in March 1930 by the United States Department of Agriculture.

Distribution.—None.

Synonyms.—Avena Capa, Pampa.

Pampa (C. I. 2767) (*173*) is similar to Capa (C. I. 2765) and was received under the designation "Avena 64s." It was obtained from Alberto Boerger, Instituto Fitotecnico y Semillero Nacional at "La Estanzuela," Departamento Colonia, Uruguay. The original packet of seed was forwarded directly to the plant pathology section of the Iowa Agricultural Experiment Station, Ames, in August 1929. Avena 64s has been renamed "Pampa," because pathologically it differs slightly from Capa.

Quincy Gray

Description.—Juvenile growth semiprostrate; plants midseason, short (60 to 90 cm.); culms midsized, stiff, glabrous at the nodes; sheaths dark-green, hairy; culm leaves midwide, margins ciliate on lower third; peduncles midsized, straight, occasionally not fully exserted; panicles equilateral, erect, small, short to midlong, narrow, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, ascending, scabrous; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 26 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains midplump; lemmas light-gray; first lemmas midlong to long (17 to 21 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 7 to 10 mm. long; second lemmas 12 to 15 mm. long; awns absent; caryopses 5 to 8 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 92.

FIGURE 92.—Spikelets and florets of Quincy Gray. (× 1.)

Quincy Gray, an intermediate to spring common oat, is differentiated from Hay by its semiprostrate or almost prostrate early growth and by more tillers than the average spring variety. It is later in maturity, has larger culms, and has more compact panicles. Under certain climatic conditions, where lemma color fails to develop fully, Quincy Gray may be wrongly classified as a white oat. It is resistant to the more common races of crown rust and the oat smuts. Quincy Gray is susceptible to Victoria blight, which has greatly reduced its economic value within the area of adaptation. Quincy Gray is of considerable taxonomic interest and may be of value for breeding grazing oats for the South.

History.—Quincy Gray (C. I. 4078) originated from a cross between a selection from a Victoria-Norton cross and a strain of Red Rustproof oats (*158, p. 45*). The cross was made about 1931 by S. J. Hadden, who was then located at

the Georgia Agricultural Experiment Station, Experiment. Seed of early generations was sent to J. D. Warner, of the North Florida Experiment Station, Quincy, to obtain plant populations from which to isolate crown-rust-resistant lines under the severe epidemics that occur in that section nearly every year. From the material of this cross that was retained at Quincy, Quincy Gray was developed and increased. It was distributed for growing on farms in the fall of 1940. The strains of the Norton oat, one of which was used as a parent of Quincy Gray, have been too variable to be considered as a distinct varietal type in these studies.

In most years, under Florida conditions, the grains appear grayish white rather than gray, hence, the name "Quincy White was applied by the Florida Agricultural Experiment Station. When grown under a more favorable environment for oats, however, the gray color develops fully and the variety could not be classified otherwise than as a gray oat.

Distribution.—Grown to a very limited extent.

Synonyms.—Quincy 2, Quincy White.

Cornellian

Description.—Juvenile growth erect; plants midseason, midtall to tall (90 to 140 cm.); culms small to midsized, stiff, hairy at the nodes; sheaths light-green, usually glabrous; culm leaves narrow to midwide, margins glabrous or slightly ciliate on lower third; peduncles small, straight, fully exserted; panicles equilateral, erect or slightly drooping, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, spreading or drooping from the middle outward; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 25 mm. long, 6 to 7 mm. wide, 9- or 10-veined, very light-green and somewhat glaucous before maturity; grains slender; lemmas gray; first lemmas midlong (16 to 18 mm.), glabrous; basal hairs several to numerous, short; awns few or absent; caryopses 6.0 to 8.5 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 4 to 7 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 93.

Cornellian, a very uniform spring variety, is distinct in having gray, midlong, awnless lemmas, with a brownish palea, and rather slender grains. It differs primarily from Hay in having much taller culms and few or no awns.

FIGURE 93.—Spikelets and florets of Cornellian. (× 1⅓.)

History.—Cornellian (C. I. 1242) (*103, pp. 8–9*) is a pure-line selection from a variety with equilateral panicles to which the name "Canada Cluster" had been applied. The head selection was made at Ithaca, N. Y., in 1912. It was developed by the Department of Plant Breeding, Cornell University, in cooperation with the United States Department of Agriculture and registered as an improved variety (*170*). It was first distributed to farmers as Pedigreed or Selection Number 110–36, in 1920, and named "Cornellian" during farmers' week at Cornell University, February 1921.

In 1935 (*156, p. 383*) about 20 percent of the oat acreage of New York was devoted to Cornellian, but it is now being replaced by improved disease-resistant varieties.

Distribution.—Grown in New Jersey, New York, and Pennsylvania.

Synonym.—White Queen.

The name "White Queen" (C. I. 1700) was applied to a gray oat similar to Cornellian that apparently was placed on the market about 1907 by a commercial seed company of Lincoln, Nebr.

Terry

Description.—Juvenile growth erect; plants midseason, midtall (90 to 120 cm.); culms midsized, fairly stiff, glabrous at the nodes; sheaths light-green, glabrous; culm leaves midwide, margins glabrous or slightly ciliate on lower third; peduncles small to midsized, slightly curved, fully exserted; panicles equilateral, drooping, large, long, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches long, spreading, scabrous; spikelets numerous, 2- or 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 28 mm. long, 5 to 7 mm. wide, 9- to 10-veined, light-green and glaucous before maturity;

grains slender; lemmas gray; first lemmas midlong to long (18 to 21 mm.), glaucous (grayish bloom), glabrous; basal hairs few to several, short; awns numerous, dark-colored on lower parts, twisted and geniculate, 25 to 40 mm. long; caryopses 8 to 11 mm. long; second lemmas 12 to 15 mm. long; awns absent; caryopses 6.0 to 8.5 mm. long; second floret rachilla segments usually sparsely hairy, midlong to long (2.0 to 2.5 mm.). Spikelet and florets shown in figure 94.

FIGURE 94.—Spikelets and florets of Terry. (× 1.)

Terry, a spring oat, differs primarily from White Maine in having slightly longer and more glaucous lemmas and glabrous culms at the nodes. Terry also has numerous awns that usually are very long, twisted and geniculate, and decidedly dark-colored on the lower parts.

History.—Terry (C. I. 602, P. I. 25850) was introduced into this country from Madrid, Spain, in 1909, by the United States Department of Agriculture (197). It was presented by A. Ramirez, Madrid, Spain, and was described as a large white oat. The name "Terry" was applied to the variety to avoid using the designation "C. I. 602" of Etheridge (61, *p. 149*).

Distribution.—None.

Synonym.—"C. I. 602" of Etheridge.

White Maine

Description.—Similar to Cornellian except for the following characters: Plants midseason to late; culms midsized to large; sheaths glabrous or slightly hairy; leaf margins ciliate; panicles very large, drooping, branches long, drooping from the middle outward; lemmas gray to grayish-white; awns numerous, dark-colored on lower parts, nontwisted to twisted and geniculate, 15 to 30 mm. long; second lemmas gray; second floret rachilla segments usually glabrous. Spikelets and florets are shown in figure 95.

White Maine, a spring variety, differs from Cornellian in having very large, long, drooping panicles with drooping branches and numerous awns. It also is later in maturity and the gray color of the lemmas usually does not develop so distinctly as in Cornellian, frequently the gray color being more intense in the second than in the first lemma.

FIGURE 95.—Spikelets and florets of White Maine. (× 1.)

History.—The origin of White Maine (C. I. 1092) is undetermined.

Distribution.—Grown to a very limited extent.

Richland

Description.—Juvenile growth erect; plants early, short (65 to 85 cm.); culms small, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous; culm leaves narrow, margins glabrous; peduncles small, straight, usually fully exserted; panicles equilateral, usually erect, small, short, narrow to midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 6; branches short to midlong, ascending or drooping, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5 to 7 mm. wide, 8- to 9-veined, light-green and somewhat glaucous before maturity; grains slender, few or none double; lemmas yellow; first lemmas midlong (15 to 18 mm.), glabrous; basal hairs few to several, short; awns few to common, nontwisted to twisted and subgeniculate, 10 to 30 mm. long; caryopses 6.5 to 8.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments usually glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 96.

Richland, an early spring type oat, is distinct in having short, small culms, slender grains, and bright-yellow lemmas. Richland cannot always be easily distinguished from the original Kherson or other yellow-seeded sibs and strains. As a rule it is a little earlier, shorter in the

FIGURE 96.—Spikelets and florets of Richland. (× 1⅛.)

straw, and more uniform in height and other plant characters than the original Kherson. It also is highly resistant to stem rust of oats and has proved to be a valuable parent for use in breeding stem-rust-resistant varieties. The short straw also has made Richland an excellent variety for growing on rich bottom soils of the Corn Belt where taller varieties frequently lodged.

History.—Richland (C. I. 787, Iowa No. 105) was developed cooperatively by the Iowa Agricultural Experiment Station and the United States Department of Agriculture at Ames, Iowa. It was registered as an improved variety (*170*). The first published statement on Richland appeared with that of Albion (Iowa No. 103) (*3, p. 771*).

> The Iowa 105 variety [Richland] of oats was also discovered by Mr. Burnett in 1906. In one of the Kherson rows he found a plant which was several inches shorter than any of the others, and apparently a little earlier. He thought that this plant, being a dwarf, might withstand lodging, and so he saved it with considerable care. . . . The tests in 1907, 1908 and 1909 proved beyond much question that both the Iowa 103 and the Iowa 105 were decidedly worth while, and from then on the seed was saved very carefully. By 1913, there was enough seed of the Iowa 103 to send out to forty farmers in different sections of the state. . . . In 1914, the Iowa 105 oats were sent out, and they also, on the average, proved to be four or five bushels per acre superior to the home variety. . . .

Owing to the important forward step that was made in oat improvement by the development of Richland, additional statements have been published (*19, p. 10; 156, p. 382*). The Iowa Agricultural Experiment Station estimated that more than 500,000 acres of Richland oats were grown in Iowa in 1924. The acreage of Richland was reported as probably being greater than 1,200,000 acres in 1935 (*80, p. 337*). In the early forties, however, Richland was almost completely replaced by the Boone, Tama, and Vicland varieties, which in turn were replaced by varieties with resistance to Victoria blight in the late forties.

Distribution.—Grown in California, Illinois, Indiana, Iowa, Minnesota, Missouri, Nebraska, Pennsylvania, South Dakota, and Wisconsin.

Synonyms.—Iowa No. 105, Richland No. 52.

"Iowa No. 105" (C. I. 787) was the name first applied to Richland by the Iowa Agricultural Experiment Station and is still known to many farmers of Iowa under this name. Richland No. 52 (C. I. 3002) was developed as a selection from a supposedly natural hybrid between Richland and an unknown variety at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1928 (*156, p. 357*). Under certain conditions it is a slightly more vigorous oat than Richland. Richland No. 52 was first grown on farms in southeastern Iowa in 1937 and replaced to some extent the parent variety. It is now little grown.

Hajira

Description.—Hajira, a spring oat, differs from Richland in growing a little taller, in having slightly more slender grains and few or no awns, and in being more drought resistant. Like Richland, Hajira is resistant to many races of stem rust.

History.—Hajira (C. I. 1001) (*100, pp. 28–29*) was introduced into the United States through the Plant Introduction Section (*197*). According to J. Burtt Davy, botanist, "*Hajira* rustproof oats," was an introduction that had been grown with some success in the dry sections of the western Transvaal and claimed to be rust resistant.

In 1904, H. S. du Toit, chief of the Division of Agricultural Education and Extension, Department of Agriculture, Pretoria, Union of South Africa, obtained a small parcel of seed from Hajira, or El-Hajira, a city in Algeria. The variety was unknown to Du Toit and had apparently no particular name, so it was named "Hajira" after the city."

According to W. G. Stahl, senior research officer, Division of Field and Animal Husbandry, Department of Agricul-

[11] Letter from H. S. du Toit, dated July 2, 1928.

ture, Union of South Africa,[18] Du Toit, after introducing the Hajira oat, subsequently grew it at Lichtenburg and in western Transvaal and then distributed it to various other semiarid parts of what now constitutes the Union of South Africa. He mentions that since its introduction the name "Hajira" has become corrupted and is variously spelled "Heijara," "Hajera," and "Heijira."

In Canada Hajira has been used in certain hybrids as a stem-rust-resistant parent with excellent results.

Distribution.—None.

Osage

Description.—Osage, a spring oat, differs from Richland in producing more tillers, in growing a little shorter, and in having slightly more drooping panicles, slightly longer lemmas, and more slender grains with tails, or hulls, that extend beyond the end of the caryopses farther than in most varieties. It has fewer awns and morphologically is a slightly variable variety. Osage is resistant to the races of crown rust and stem rust common to Kansas and has some resistance to the oat smuts, but it is highly susceptible to Victoria blight.

History.—Osage (C. I. 3991) (*34*, *75*) originated from a cross made by F. A. Coffman between Fulton and a strain of Victoria × Richland at Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1935. Osage was developed cooperatively by the Kansas, Idaho, and Iowa Agricultural Experiment Stations and the United States Department of Agriculture. It was first distributed to Kansas farmers in 1946. It is registered as an improved variety (*154*, *v. 42*). Because of high susceptibility to Victoria blight, it is being replaced by resistant varieties.

Distribution.—Grown to a very limited extent.

Synonym.—Ventura.

Kherson

Description.—Similar to Richland except for the following characters: Plants short to midtall (70 to 95 cm.); awns common to numerous, nontwisted to twisted and subgeniculate. Spikelets and florets are shown in figure 97.

Kherson, a spring oat, differs from Richland only in having slightly taller culms, more slender grain, and usually more awns. As has been shown (*38*), the original Kherson oat is not homozygous for all characters, such as type of spikelet separation, presence or absence of basal hairs, extent of awning, type of awn, and color of lemma. As a consequence, Kherson, in plant and grain characters, is a much less uniform variety than either Richland or Iogold.

FIGURE 97.—Spikelets and florets of Kherson. (× 1⅛.)

History.—According to Lyon (*104*) and Warburton and Stanton (*206*, *pp. 2–4*), Kherson (C. I. 459) was introduced into the United States in 1896 from southern Russia by the Nebraska Agricultural Experiment Station, through F. W. Taylor, then superintendent of Farmers' Institutes in Nebraska, who collected oats while traveling through Russia. As the oat was collected in the then so-called Kherson Government, the name "Kherson" was applied to it. The origin of this oat in Russia is not known. Kherson was grown on about 3 million acres in 1919. It has been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Synonyms.—Fort, Orloff, Seventy-five Day, Sixty-Day.

Fort, an unaccessioned strain of Kherson that originated on the farm of a Mr. Fort in Illinois, has been tested by the Illinois Agricultural Experiment Station at Urbana. Fort has not attained any economic importance.

Orloff (C. I. 2569) is a strain of Kherson oats that has been grown in Canada. Cerealist W. T. G. Wiener, University of Manitoba Agricultural College, Winnipeg, wrote concerning Orloff as follows:[19]

> The history and development of the Orloff oat is not known to us. We obtained the seed from a local seed house in 1914, under this name. Our trials proved it to be similar to the old variety known as 60-day (Kherson). For a number of years this variety was grown quite generally in the northern

[18] Letter from W. G. Stahl, dated July 6, 1928.

[19] Letter from W. T. G. Wiener to T. R. Stanton, dated January 31, 1920.

sections of this province, but after four or five years was discarded by most growers. . . .

Orloff has not been grown commercially in the United States.

"Seventy-five Day" (C. I. 337) is a name that was applied to an unnamed importation of Kherson oats from Russia made about June 1, 1900 (P. I. 5168) (*197*). According to Warburton and Stanton (*206, p. 3*), an earlier importation from S. de Mrozinski was unnamed, but undoubtedly is identical with the Sixty-Day. It was grown at a few agricultural experiment stations under the name of "Seventy-five Day," but never attained much economic importance.

According to Warburton and Stanton (*206, p. 3*), seed of the Sixty-Day (C. I. 165) variety was received by the United States Department of Agriculture (P. I. 5938) (*197*) on March 6, 1901, from S. de Mrozinski, of Proskurov, in the Podolia Government of Russia. This province is adjacent to and just west of the then Kherson Government and has essentially the same climatic and soil conditions. Sixty-Day is said to have been originated by De Mrozinski, but no information is at hand regarding the source of the material from which he made his selection. It is very probable, however, that Kherson is from the same original stock, as the two varieties are practically identical in every way and were obtained from adjoining provinces.

Both Kherson and Sixty-Day have been widely distributed in the United States, though probably the Sixty-Day is more widely grown. Fully one-half or more of Kherson oats were reported as Sixty-Day in the varietal survey of 1919. The name "Kherson" is preferable, as the farmer is often misled by the name "Sixty-Day," believing that it should mature in 60 days.

Carleton

Description.—Carleton, a spring oat, differs from Richland in ripening a few days later, in growing slightly taller, and in having little larger culms and little longer lemmas. The culms usually are rather hairy at the nodes, as is so characteristic of the Markton parent. Carleton also is heavily awned, the awns being mostly of the twisted and geniculate type. It is highly resistant to nearly all races of the oat smuts. This character definitely separates Carleton from Kherson, Richland, and Iogold.

History.—Carleton (C. I. 2378) (*156*) was originated from a cross between Sixty-Day and Markton oats made by the writer at Arlington Experiment Farm, Rosslyn, Va., in 1919, at which time the second parent was an unnamed selection. In 1921, seed from the F_1 plants grown at Arlington Farm was sown by D. E. Stephens at Moro, Oreg., where it was grown and selected in the F_2 to F_6 generations. In 1925 B. B. Bayles, then at the Sherman Branch Experiment Station at Moro, smutted the seed from 204 selections. Seventy of the F_6 lines were free from smut and 93 showed an infection of 95 percent or more. The 70 smutfree selections were again free from smut in 1926. In 1927, 33 of these lines were distributed to other stations for testing. Selection 1045a3–1–4–1 (C. I. 2378) was outstanding in appearance and in yield at Ames, Iowa, in 1927, and continued to be productive at Ames and at stations in other States. This strain was named Carleton in 1931 in honor of the late Mark Alfred Carleton and was first distributed to farmers in 1937. Carleton is registered as an improved variety (*154, v. 30*).

Distribution.—Grown principally as a dryland variety in Idaho, Montana, Oregon, Washington, and Wyoming.

Iogold

Description.—Similar to Richland except for the following characters: Plants short to midtall (75 to 95 cm.); culms small to midsized; panicles small to midsized, short to midlong; spikelets 2-flowered or occasionally 3-flowered; grains midplump; first lemmas midlong (16 to 18 mm.); awns few or absent. Spikelets and florets are shown in figure 98.

FIGURE 98.—Spikelets and florets of Iogold. (× 1¼.)

Under most environments Iogold, a spring oat, grows a little taller, ripens a few days later, and produces slightly plumper grains than Richland. The culms also are slightly larger. Like Richland, Iogold is highly resistant to most races of stem rust (*100, p. 7*).

History.—Iogold (C. I. 2329) was originated in 1906 as a pure-line selection

(Iowa No. 109) from the Kherson variety. The plant selection was made by the late L. C. Burnett (*18*) and subsequently tested by the Iowa Agricultural Experiment Station in cooperation with the United States Department of Agriculture. It is registered as an improved variety (*172*). Iogold was first distributed to farmers of Iowa in the spring of 1927. About 1 million acres of Iogold were grown in Iowa in 1935 (*156, p. 382*). Relatively large acreages also were grown in many other States until replaced by more completely disease-resistant varieties.

Distribution.—Grown to a limited extent.

Edkin

Description.—Differs from Iogold in growing a little taller and in having more awns and slightly more slender grains. It is about equal with Iogold in stem rust resistance. Edkin, a spring oat, has been listed as a superior variety (*156, p. 390*).

History.—Edkin (C. I. 2330) was originated as a pure-line selection (459–14–3) from Kherson (C. I. 459) made by F. A. Coffman at the United States Dry Land Field Station, Akron, Colo., in 1922, in cooperation with the Colorado Agricultural Experiment Station.

Distribution.—Grown to a very limited extent.

Boone

Description.—Juvenile growth erect; plants early, short to midtall (70 to 100 cm.); culms small, stiff, glabrous at the nodes; sheaths dark-green, usually glabrous; culm leaves midwide, margins usually glabrous; peduncles small, straight, fully exserted; panicles equilateral, erect or slightly drooping, small to midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 6; branches short to midlong, drooping from the middle outward, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5 to 7 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains plump, some double; lemmas yellow; first lemmas midlong (16 to 18 mm.), glabrous; basal hairs few to several, short to midlong; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 10 to 13 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 99.

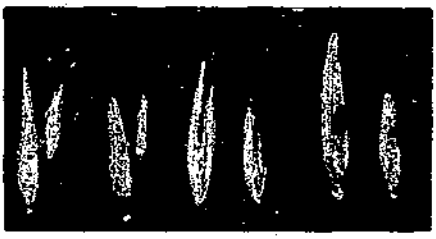

FIGURE 99.—Spikelets and florets of Boone. (× 1.)

Boone, a spring oat, usually can be differentiated from Richland and similar spring types by its deep yellow lemmas and plumper grains, a small percentage of which are double. It is a vigorous variety, with resistance to smut, crown rust, and stem rust, and a good agronomic type—a combination not previously available in any oat variety. It is highly susceptible to Victoria blight and halo blight.

History.—Boone (C. I. 3305) was the first of many lines selected from the well known cross (XS1098) Victoria × Richland to be named (*112, 113; 156, p. 393; 174*). This cross was made at Arlington Farm, Rosslyn, Va., by the writer in 1930. Boone was developed cooperatively by the Iowa and Idaho Agricultural Experiment Stations and the United States Department of Agriculture. It was registered (*154, v. 32*) and was first distributed for growing on farms in Iowa in 1940.

Distribution.—Grown to a very limited extent.

Cedar

Description.—Cedar, a spring variety, differs from Boone in growing a little taller and being a little more vigorous. It also is slightly more uniform in some plant and grain characters.

History.—Cedar (C. I. 3314) originated as a sib (selection 522) of Boone (selection 509) (*112, 113, 156, 174*) and hence has the same origin. Victoria × Richland plant material grown at Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1934, gave rise to selection 522, which was grown in a nursery row at Ames, Iowa, in 1935. It was carried in the cooperative experiments at Ames by the Iowa Agricultural Experiment Station and the United States Department of Agriculture until the spring of 1938, when seed of it and several sister selections were sent to the Nebraska Agricultural Experiment Station at Lincoln for field tests. Because of its excellent yield and high resistance to the rusts and smuts, selection 522 was named "Cedar" by the Nebraska and Iowa Agricultural Experiment Stations in 1943. Cedar was first

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distributed to Nebraska farmers in 1944 and is registered as an improved variety (*154, v. 36*).

It was formerly grown in Iowa, Nebraska, and Kansas, but, owing to its susceptibility to Victoria blight, Cedar is being replaced by resistant varieties.

Distribution.—Grown to a very limited extent.

Control

Description.—Control, a spring variety, differs from Boone in growing a little taller. It also is less uniform in some plant and grain characters.

History.—Control (C. I. 3603) is a composite of two sister selections of Boone (Nos. 517 and 520) (C. I. Nos. 3309 and 3312) (*112, 113, 156, 174*). These two strains were sown in separate increase plots at Ames, Iowa, in 1939 and at harvest, apparently because of great similarity, were threshed together. This seed was turned over to the Botany Department by the Agronomy Department of Iowa Agricultural Experiment Station for sowing increase fields on the experimental farm at Kanawha and on farms of other public-service institutions in Iowa, from which it was distributed to farmers. It was developed cooperatively by the Idaho and Iowa Agricultural Experiment Stations and and the United States Department of Agriculture. Because of its susceptibility to Victoria blight, Control is being replaced by resistant varieties.

Distribution.—Grown to a very limited extent.

Tama

Description.—Tama, a spring oat, differs from Boone in ripening a little earlier and being more uniform in plant and grain characters. It also has a little weaker straw and may lodge more easily, although its yields are slightly higher.

History.—Tama (C. I. 3502) originated as a plant selection (Iowa selection 35–548) from plant material of the Victoria × Richland cross that had been grown continuously at Ames, Iowa, and was first distributed for sowing on farms in Iowa in 1942. It is registered as an improved variety (*154, v. 34*) It was developed cooperatively by the Iowa and Idaho Agricultural Experiment Stations and the United States Department of Agriculture (*112, 113, 156, 174*). Tama has been mostly replaced by resistant varieties because of its susceptibility to Victoria blight.

Distribution.—Grown to a very limited extent.

Vicland

Description.—Vicland, a spring oat, differs from Boone in growing a little taller and in being more uniform in certain plant and grain characters. Although Vicland usually produces more awns and fatuoids than Boone, Cedar, Control, Tama, and Vikota, nevertheless it has been one of the most widely distributed and productive of this group of varieties.

History.—Vicland (C. I. 3611, selection 5545–16) (*112, 113, 145, 156, 174*) originated as a selection from the Victoria × Richland cross, which was made at Arlington Farm, Rossiyn, Va., in 1930. Selections of the original cross were tested in early generations in cooperation with the Idaho and Iowa Agricultural Experiment Stations and the United States Department of Agriculture, and, of these, 33 selections were sent to the Wisconsin Agricultural Experiment Station in the spring of 1935. One line, selection 5545–16, was isolated by H. L. Shands, subsequently tested, and named Vicland in 1940. It is a registered variety (*154, v. 33*) and is the product of cooperation by the Wisconsin, Iowa, and Idaho Stations and the United States Department of Agriculture. It was distributed to Wisconsin farms in 1941 by the Wisconsin station. In 1945 Vicland was grown on 98 percent of the oat acreage of Wisconsin and widely grown in Illinois, Indiana, Minnesota, North Dakota, Ohio, Pennsylvania, and South Dakota. Victoria blight has greatly reduced the acreage of Vicland, and hence, it has been mostly replaced by resistant varieties.

Distribution.—Grown to a limited extent.

Vikota

Description.—Vikota, a spring oat, differs from Boone in growing a little taller and in being more uniform in plant and grain characters. Vikota has a slightly weaker straw than Tama.

History.—Vikota (C. I. 3602) (*112, 113, 156, 174*) originated from one of several selections closely related to Tama that were sent for testing to the South Dakota Agricultural Experiment Station, Brookings, in 1941. The origin is the same as that of Tama. Selection C. I. 3602, being one of the most promising strains at Ames, was later named jointly by the South Dakota and Iowa Agricultural Experiment Stations and the United States Department of Agriculture. It was first distributed to farmers in South Dakota in 1943. Owing to its susceptibility to Victoria blight, Vikota is being replaced by resistant varieties.

Distribution.—Grown to a very limited extent.

State Pride

Description.—Juvenile growth erect; plants early, midtall (90 to 110 cm.); culms small, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous; culm leaves narrow, margins usually glabrous; peduncles small, straight, usually fully exserted; panicles equilateral, erect, small, short, narrow to midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 6; branches short to midlong, ascending or slightly drooping, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5 to 7 mm. wide, 8- to 9-veined, light-green and slightly glaucous before maturity; grains slender; lemmas yellow; first lemmas midlong (16 to 18 mm.), glabrous; basal hairs few to several, short; awns few or absent; caryopses 6.5 to 8.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.0 to 7.0 mm. long; second floret rachilla segments usually glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 100.

FIGURE 100.—Spikelets and florets of State Pride. (× ¾.)

State Pride, a spring oat, is decidely the tallest of any variety originating as a selection from Kherson, which character is used to distinguish it morphologically from varieties such as Richland and Iogold. State Pride has no resistance to the rusts and smuts.

History.—State Pride (C. I. 1154) (*156*) was originated by the Wisconsin Agricultural Experiment Station, Madison, in 1907, as a pure-line selection from the Kherson variety. It was selected by the late R. A. Moore, of the Department of Agronomy, University of Wisconsin. It is registered as an improved variety (*170*). Leith and Delwiche (*98, p. 9*) also recorded a brief history of State Pride. It was grown on about 50 percent of the oat acreage of Wisconsin in 1936, but it has been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Synonym.—Wisconsin Pedigreed No. 7.

Hawkeye

Description.—Hawkeye, a spring oat, differs from State Pride in being a little later in maturity, in growing a few inches shorter, and in having slightly plumper grains. Hawkeye is resistant to most races of stem rust, which definitely separates it from State Pride.

History.—Hawkeye (C. I. 2464, Iowa No. 102) (*156, pp. 391–392*) originated as a selection from a cross between Richland (Iowa No. 105, C. I. 787) and Green Russian (Iowa No. 96, C. I. 2890) that was made at Ames, Iowa, in 1919 by S. M. Dietz, who formerly was in charge of cooperative oat crown rust investigations with the United States Department of Agriculture at the Iowa Agricultural Experiment Station.

Distribution.—Grown to a very limited extent.

Iowa No. D67 and Iowa No. D69

Description.—Iowa No. D67 and Iowa No. D69, spring varieties, differ from State Pride in being a little later in maturity and in having slightly shorter straw. They differ primarily from State Pride in having high resistance to many races of stem rust. Neither has been distributed extensively for growing on farms, but both have contributed much to oat improvement as rust-resistant parents of hybrids.

History.—Iowa No. D67 (C. I. 2870) and Iowa No. D69 (C. I. 2463) (*156, pp. 391–392*) are sibs or near sibs of Hawkeye, and thus have the same history.

Distribution.—Grown to a very limited extent.

Markton

Description.—Juvenile growth erect; plants early to midseason, short to midtall (70 to 110 cm.); culms midsized, fairly stiff, very hairy at the nodes; sheaths light-green, glabrous or slightly hairy; culm leaves midwide, margins occasionally ciliate on lower third; peduncles midsized, straight, occasionally not fully exserted; panicles equilateral, drooping, large, midlong, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches very long, drooping from the middle outward, apical branches attenuated; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 24 to 28 mm. long, 6 to 8 mm. wide, 9- to 11-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas yellow; first lemmas midlong to long (18 to 21 mm.), glabrous; basal hairs few to several, short; awns

numerous, twisted and geniculate, 20 to 35 mm. long; caryopses 7.5 to 9.5 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 6.5 to 7.5 mm. long; second floret rachilla segments glabrous, long (2.5 to 3.5 mm.). Spikelets and florets are shown in figure 101.

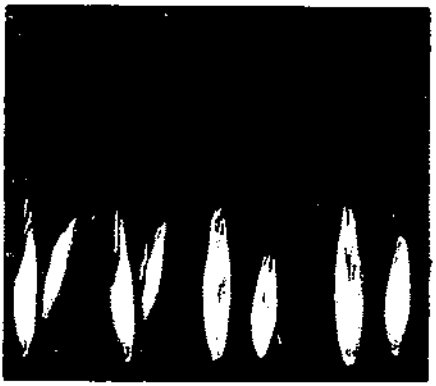


FIGURE 101.—Spikelets and florets of Markton. (× 1.)

Markton, a spring oat, is distinct morphologically in having very hairy culms at the nodes, large panicles, midlong to long, yellow lemmas, and numerous rather strongly twisted and geniculate awns. At time of heading, the plants are lighter green, which also serves as a further mark of differentiation. It is highly resistant to the smuts of oats and has proved exceedingly valuable as a parent in crosses for the breeding of resistant varieties.

History.—Markton (C. I. 2053) (*156, p. 384; 175*) was selected from an unnamed and unselected variety obtained from Dedeagach (Alexandroupolis), Turkey, by the late M. A. Carleton from the exhibit of Louis Dreyfus & Co., at the Louisiana Purchase Exposition held in St. Louis, Mo., in 1904. This lot of seed was accessioned as C. I. 357 and distributed to several agricultural experiment stations where it was grown for a few years and then discontinued on most stations. At the Sherman Branch Station, Moro, Oreg., however, several selections were made from it by J. J. C. Umberger in 1911, and the seed from these selections was sown in head rows in 1912. Seed from the highest yielding head row was sown in four 8-rod nursery rows by D. E. Stephens in 1913. A 20th-acre plot was sown in 1914. The selection continued to show good performance, and its high resistance to covered smut was discovered by the late E. F. Gaines of the Washington State Agricultural Experiment Station, Pullman. In the spring of 1922, it was distributed to a limited extent in central Washington by the Waterville Branch Station and in Oregon by the Sherman Branch Station. This oat was tentatively named "Carleton"; however, in order to conform with the rules of nomenclature of the American Society of Agronomy, it was renamed "Markton" in November 1923. Markton is registered as an improved variety (*170*). It is the product of cooperative investigations of the Oregon and Washington Agricultural Experiment Stations and the United States Department of Agriculture.

Distribution.—Grown in Arizona, Colorado, Idaho, Montana, Oregon, Utah, Washington, and Wyoming.

Hancock

Description.—Hancock, a spring oat, differs from Markton in having a much stiffer straw, slightly smaller, less drooping, and compact panicles, lighter yellow lemmas, and fewer awns. Hancock is resistant to many races of stem rust and carries the smut resistance of the Markton parent. Resistance to stem rust definitely separates Hancock from Markton.

History.—Hancock (C. I. 3346) was originated from a cross (X2871) between Markton and Rainbow (*36, p. 801*) oats made at the Arlington Farm, Rossiyn, Va., by F. A. Coffman in 1928. It was subsequently developed in cooperative experiments of the United States Department of Agriculture and the Iowa and Idaho Agricultural Experiment Stations and registered as an improved variety (*154, v. 32*). Hancock was first distributed to farmers of northern Iowa in 1940 as a special-purpose variety for growing with and combining over newly sown stands of sweetclover.

Distribution.—Grown to a very limited extent.

Miomark

Description.—Miomark, a spring oat, differs from Markton in ripening a little earlier and in being a slightly less vigorous variety, although the two varieties are morphologically similar. Miomark, however, is resistant to many races of stem rust and the oat smuts. The resistance to stem rust definitely separates Miomark from Markton.

History.—Miomark (C. I. 3418, S. Dak. Sel. No. 40) resulted from a selection of logold × Markton backcrossed to Markton by Matthew Fowlds at the South Dakota Agricultural Experiment Station, Brookings. It was released for farm production in South Dakota in 1941 (*185*).

Distribution.—Grown to a very limited extent.

South Dakota No. 334

Description.—South Dakota No. 334, a spring oat, differs from Markton in ripening a few days earlier and in having a little shorter straw. It is highly resistant to most races of stem rust, which rather definitely separates South Dakota No. 334 from Markton. It also is resistant to the oat smuts.

History.—South Dakota No. 334 (C. I. 2884) was developed by Matthew Fowlds, formerly of the South Dakota Agricultural Experiment Station, Brookings, by a series of backcrosses. According to Mr. Fowlds,[20] South Dakota No. 334 originated from a cross of Swedish Select × Kilby (hull-less). A naked selection from this cross was backcrossed twice to Richland (C. I. 787) and finally to the Markton (C. I. 2053) variety.

Distribution.—Grown to a very limited extent.

Madrid

Description.—Juvenile growth erect; plants midseason, midtall (90 to 110 cm.); culms midsized, stiff, glabrous or sparsely hairy at the nodes; sheaths dark-green, glabrous; culm leaves midwide, margins glabrous or slightly ciliate on lower third; peduncles midsized, straight, fully exserted; panicles equilateral, erect, midsized, short, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short, drooping from the middle outward or ascending, scabrous; spikelets few to numerous, many 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains plump; lemmas yellow; first lemmas midlong (16 to 18 mm.), glabrous; basal hairs few or absent; awns numerous, nontwisted to twisted and subgeniculate, 10 to 25 mm. long; caryopses 7.0 to 8.5 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 7.0 mm. long; second floret rachilla segments glabrous, short to midlong (1 to 2 mm.). Spikelets and florets are shown in figure 102.

Madrid, a spring oat, differs from Markton in having smaller and stiffer panicles, shorter lemmas, and some 3-flowered spikelets. Madrid also is almost completely awned like Markton.

History.—Madrid (C. I. 603) was introduced from Madrid, Spain, in 1909, by the United States Department of Agriculture (P. I. 25851) (*197*). It was presented by A. Ramirez of Madrid, Spain, and was received simply as "common oat." No information concerning its origin in Spain is available.

FIGURE 102.—Spikelets and florets of Madrid. (× 1.)

Distribution.—Grown to a very limited extent in western Oregon.

Synonym.—"C. I. 603" of Etheridge.

Madrid was classified by Etheridge (*61, p. 147*) under the name "C. I. 603," which strain has been grown experimentally only.

Aurora

Description.—Similar to Madrid except for the following characters: Juvenile growth semiprostrate to erect; culms hairy at the nodes; sheaths light-green; panicles small to midsized; first lemmas short (13 to 15 mm.); basal hairs few to several, short to midlong; awns few or absent. Spikelets and florets are shown in figure 103.

FIGURE 103.—Spikelets and florets of Aurora. (× 1⅛.)

Aurora, an intermediate spring type, is distinct from Madrid in being more prostrate in early growth, in being a little earlier in maturity, and in having hairy culm nodes, smaller panicles, very few or no awns, and slightly shorter lemmas. The character of frequently producing 3 florets to the spikelet is common to both, which distinctly separates these varieties from the others of the midseason, yellow group. The short, plump, and well-formed grains of Aurora are very desirable. Aurora also is slightly winter-hardy.

[20] Letter from Mr. Fowlds, dated October 22, 1938.

History.—Aurora (C. I. 831) originated as a pure-line selection from Red Rustproof (Appler) oats, made by the late C. W. Warburton at Arlington Farm, Rosslyn, Va., in 1909 (*156, p. 397; 159, p. 11*). It was distributed to a limited number of farmers in Mississippi in 1914 as a fall-sown variety, but it did not become popular because of high susceptibility to the rusts and smuts.

Distribution.—Grown to a very limited extent.

Synonym.—Yellow Peruvian.

Yellow Peruvian (C. I. 975) is a strain of Aurora that has been grown at the West Tennessee Experiment Station, Jackson. It is said to have been obtained as a sample from a boxcar of oats shipped into South Carolina. C. S. Looney, a farmer of Winchester, Tenn., claims that he introduced the Yellow Peruvian oat, but no information could be obtained concerning the source of his original seed. This strain of the Aurora type is probably not grown commercially under the name of "Yellow Peruvian."

Minota

Description.—Juvenile growth erect; plants midseason, short to midtall (60 to 100 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous; culm leaves midwide, margins glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, drooping, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, spreading to ascending, scabrous, apical branches usually attenuated; spikelets few to numerous, usually 2-flowered or occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 25 mm. long, 5.5 to 7.5 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains midplump; lemmas yellow; first lemmas midlong to long (16 to 20 mm.), glabrous, apex with greenish tinge at maturity; basal hairs few or absent; awns few to common, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 6.5 to 7.5 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 5.0 to 6.5 mm. long; second floret rachilla segments usually glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 104.

Minota, a spring-type oat, is distinguished from similar varieties by the long, attenuated, drooping apical branches of the panicles, and the greenish tinge of the apex end of the ripened lemmas. Where Minota ripens normally, these greenish tips usually are noticeable. Minota is one of the shortest strawed, midseason varieties known.

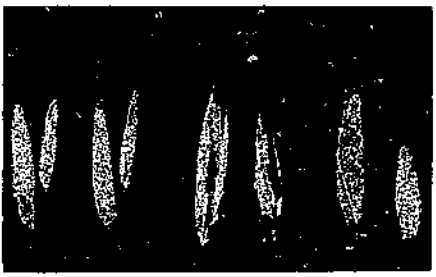


FIGURE 104.—Spikelets and florets of Minota. (× 1¼.)

History.—Minota (C. I. 1285) is a pure-line selection from an unnamed commercial variety. The original selection (Minnesota No. 512) was made on a Minnesota farm by the Minnesota Agricultural Experiment Station, St. Paul, probably as early as 1910. Minota was developed by C. P. Bull, H. K. Hayes, and A. C. Arny, and was subsequently distributed by the Minnesota Station. Minota has been registered (*170*). It was grown on less than 2 percent of Minnesota's 1935 oat acreage (*156, p. 383*).

Distribution.—Grown to a very limited extent.

Awnless Probsteier

Description.—Juvenile growth erect; plants midseason, midtall to tall (90 to 130 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous; culm leaves midwide, margins glabrous; peduncles midsized to large, straight, usually fully exserted; panicles equilateral, usually erect, midsized, midlong to long, midbroad to broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 7; branches midlong to long, spreading or ascending, scabrous, apical branches not attenuated; spikelets few to numerous, usually 2-flowered or occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 26 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas yellow; first lemmas midlong to long (16 to 19 mm.), glabrous; basal hairs numerous, short; awns few to common, twisted and geniculate, 15 to 30 mm. long; caryopses 6.5 to 7.5 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 5.0 to 6.5 mm. long; second floret rachilla segments usually glabrous, midlong (2.0

to 2.5 mm.). Spikelets and florets are shown in figure 105.

FIGURE 105.—Spikelets and florets of Awnless Probsteier. (× 1.)

Awnless Probsteier is best differentiated by the presence of small tufts of short, fine hairs at the base of the lemmas. The culms are larger and coarser than the other midseason yellow varieties, the plants a little later in maturity, and the grains are less plump. A few are awned; hence, the name "Awnless Probsteier" is somewhat of a misnomer.

History.—Awnless Probsteier (C. I. 1888) originated in 1892 at the Swedish Plant Breeding Station, Svalöf, Sweden, as a mass selection from the unselected Probsteier, or old Milton, oat (*116, p. 122*). By rejecting all plants which had the slightest trace of awn through several generations of mass selection, the Awnless Probsteier strain was finally evolved. Awnless Probsteier was first introduced into this country in 1907 by the United States Department of Agriculture (P. I. 20461) (*20, 1904, p. 100; 197*).

Distribution.—Grown to a limited extent.

Synonyms.—Beardless Probsteier, Beseler No. 1, Beseler No. 2, Milton, Probsteier, Yellow Naesgaard.

"Beardless Probsteier" (C. I. 1069) is a similar name that has been applied to a strain of Awnless Probsteier.

Beseler No. 1 (C. I. 378) is a strain of the Probsteier type that was received through the late M. A. Carleton from Germany by the United States Department of Agriculture in 1904. Beseler No. 2 (C. I. 387) was received from the same source and at the same time. Another lot of Beseler No. 1 (P. I. 25587, C. I. 592) (*197*) was received from Bucharest, Rumania, in 1909 through Horace G. Knowles, of the American Legation. These Beseler strains never were grown to any extent in the United States, although they were of considerable importance in Germany where they originated as selections from mixed populations of oats obtained from the province of Probsteï.

Mixed populations of the old Probsteier oat (C. I. 1656) apparently were introduced into the United States many years ago from various European sources by seedsmen and immigrants, the latter usually bringing with them seed of the small-grain varieties common to their homeland. The original home of Probsteier, or old Milton, oat, is the Baltic region of Europe (*116, p. 122*). Several introductions of the variety have been made by the United States Department of Agriculture (P. I. 20462, 25586) (*197*). The original Probsteier was formerly grown to some extent in Iowa, and to a very limited extent in New York, North Dakota, Maryland, Minnesota, Pennsylvania, South Dakota, Wisconsin, and West Virginia. It is now almost obsolete.

Yellow Naesgaard (C. I. 2271), a strain of Awnless Probsteier developed at the Abed Experiment Station at Copenhagen, Denmark, by H. A. B. Vestergaard, was introduced in 1914 by the United States Department of Agriculture (P. I. 37768) (*197*). It was obtained through the Danish Royal Agricultural Society, with a statement that it originated from a single plant of Beseler, an important German variety of oats. Yellow Naesgaard is grown only experimentally in the United States.

Japan

Description.—Similar to Awnless Probsteier except for the following characters: Culms small to midsized; panicles very drooping, large, midlong, broad, apical branches usually attenuated; grains slender; awns few or absent; basal hairs numerous, long; second floret rachilla segments usually slightly hairy, long (2.5 to 3.0 mm.). Spikelets and florets are shown in figure 106.

FIGURE 106.—Spikelets and florets of Japan. (× 1.)

Japan, a spring oat, differs primarily from Awnless Probsteier in having slightly smaller culms, larger and more drooping panicles, longer basal hairs,

slightly more slender grains, and deeper yellow lemmas.

History.—Japan (C. I. 1889) apparently was first placed on the market sometime during the middle eighties by a commercial seed company of Rochester, N. Y., with the claim that it was the result of special breeding on their Burr-Oaks Farm at Sibley, Ill. Further definite information on the origin of Japan has not been determined.

Distribution.—Grown to a very limited extent.

Synonym.—"Japan Selection" of Etheridge. Etheridge (*61, p. 147*) described Japan under the name "Japan Selection" (C. I. 1889).

Green Russian

Description.—Juvenile growth erect; plants midseason, midtall to tall (90 to 140 cm.); culms midsized, fairly stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, glabrous; culms leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, slightly drooping, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, spreading or ascending, scabrous, apical branches attenuated; spikelets few to numerous, usually 2-flowered or occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 25 mm. long, 5.5 to 7.5 mm. wide, 9- to 10-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas yellow; first lemmas midlong to long (16 to 20 mm.), glabrous, apex with greenish tinge at maturity; basal hairs few to several, short; awns common to numerous, twisted and geniculate, 15 to 35 mm. long; caryopses 6.5 to 7.5 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 5.0 to 6.5 long; second floret rachilla segments usually glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 107.

Green Russian, a spring oat, differs only from Minota in having taller culms, more distinctly yellow lemmas, more basal hairs, and more awns. As in Minota, the long, drooping apical branches of the panicle and the rather characteristic greenish lemma tips are the most reliable marks of identification. The strains of the Green Russian type have few outstanding marks of identification and, as a consequence, it is frequently difficult to distinguish them from other similar varieties.

FIGURE 107.—Spikelets and florets of Green Russian. (× 1⅛.)

History.—The origin of Green Russian (C. I. 1978) has not been determined. It probably was introduced from Europe into Iowa or Minnesota by Russian or other European immigrants about 1870. The variety has been of sufficient productiveness and value to persist through the years. According to varietal survey in 1919, Green Russian was grown on about 2¼ million acres.

Distribution.—Grown to a limited extent.

Synonyms.—German Rustproof, Goldmine.

German Rustproof, an unaccessioned variety, apparently was introduced for growing in 1896 by a commercial seed company of Sioux Falls, S. Dak., and is still grown by a few farmers of northern Iowa. Its origin has not been determined.

Iogren

Description.—Iogren, a spring oat, differs from Green Russian in having a little shorter straw and in being a more distinctly yellow oat. It is more uniform in plant and grain characters.

History.—Iogren (C. I. 2024) (*19*) was developed from a single panicle selection (Iowa No. 840) of the Green Russian type obtained from W. Eral, Pocahontas, Iowa. It was grown in a panicle row by the late L. C. Burnett at the Iowa Agricultural Experiment Station in 1911 and subsequently developed by that station in cooperation with the United States Department of Agriculture. It was distributed to farmers in 1922. It is a registered improved variety (*170*). Iogren was grown on 5 percent of the oat acreage of Iowa in 1935 (*156, p. 882*).

Distribution.—Grown to a limited extent.

Keystone

Description.—Keystone, a spring oat, differs from Green Russian in ripening 4 to 6 days later, in growing 5 to 10 cm. taller, and in having a little shorter, slightly more slender grains, and lighter yellow lemmas. It has no resistance to the rusts and smuts.

History.—Keystone (C. I. 2146) (*156, p. 385*) was originated as a pure-line selection (53–11) from a variety grown in Pennsylvania under the name of "Japan." The plant selection was made at the Pennsylvania State College by C. F. Noll in 1910. Keystone was first distributed to farmers of Pennsylvania in 1921. It is registered as an improved variety (*171*). Keystone in 1935 was grown on about 10 percent of the oat acreage of Pennsylvania, but it has been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Morota

Description.—Morota, a spring oat, is similar to, if not identical with, Rainbow in plant and grain characters and is also highly resistant to most races of stem rust.

History.—Morota (C. I. 2344, N. Dak. 22005) is a sib of Rainbow and consequently has the same history.

Distribution.—Grown to a very limited extent.

Patterson

Description.—Patterson, a spring oat, differs from Green Russian in ripening 4 to 6 days later, in growing 5 to 10 cm. taller, and in having shorter and more slender grains and lighter yellow lemmas. Under favorable conditions Patterson can be distinguished from Keystone on the basis of lemma color only. Patterson, like Keystone, has no resistance to the rusts and smuts.

History.—Patterson (C. I. 2147) is a sister pure-line selection from the variety that gave rise to Keystone and, hence, has the same history. It is a registered improved variety (*171*) and was first distributed to farmers of Pennsylvania in 1920. Patterson was reported as being grown on 40 percent of the oat acreage of Pennsylvania in 1935 (*156, p. 385*).

Distribution.—Grown to a very limited extent.

Rainbow

Description.—Rainbow, a spring oat, differs from Green Russian in growing a little taller, in having a stiffer straw, and in being more uniform in plant and grain characters. Rainbow is resistant to most races of stem rust. This character alone definitely separates it from the Green Russian variety.

History.—Rainbow (C. I. 2345, N. Dak. 22006) originated at the North Dakota Agricultural Experiment Station, Fargo, as a pure-line selection from Green Russian. The plant selection was made by T. E. Stoa in 1922. It was subsequently tested on experiment stations in North Dakota and adjoining States with favorable results. Rainbow was registered in 1929 (*169*). It was first distributed to farmers of North Dakota in 1929. More than 10 percent of the oat acreage of North Dakota was grown to Rainbow in 1935 (*156, p. 384*).

Distribution.—Grown to a limited extent.

Schoolmam

Description.—Schoolmam, a spring oat, differs primarily from Green Russian in growing 15 to 30 cm. taller and in having high resistance to many races of stem rust. These characters make Schoolmam rather distinct from Green Russian.

History.—Schoolmam (C. I. 2057) was collected by the late Arthur A. Bryan of the United States Department of Agriculture, on the farm of W. D. O'Brien, Estherville, Iowa, in 1925. This variety appears to have been introduced into Iowa from Michigan some 30 years before by a school teacher; hence, the name Schoolmam. Its origin in Michigan has not been determined.

Distribution.—Grown to some extent in the Pacific coast section of Oregon.

Golden Rain

Description.—Juvenile growth erect; plants midseason, midtall to tall (95 to 140 cm.); culms midsized, stiff, glabrous at the nodes; sheaths dark-green, glabrous; culm leaves midwide, margins glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, erect, small to midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short, ascending, scabrous; spikelets few to numerous, usually 2-flowered or occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 22 mm. long, 6 to 8 mm. wide, 8- to 10-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas yellow; first lemmas short (13 to 15 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 6.5 to 7.0 mm. long; second lemmas 10 to 13 mm.; awns absent; caryopses 4.5 to 6.0 mm. long; second floret rachilla segments

glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 108.

FIGURE 108.—Spikelets and florets of Golden Rain. (× 1¼.)

Golden Rain, a spring oat, is distinguished by its tall, stiff straw, more erect panicles, and shorter, golden yellow, practically awnless lemmas with slender to midplump grains. It is very high yielding and of good uniformity in nearly all characters, but it lacks disease resistance.

History.—Golden Rain (C. I. 1890) apparently was obtained for the first time in the United States from the Swedish Plant Breeding Station at Svalöf, Sweden, in 1907, under the name "Svalöf's Guldregnshafre" by the United States Department of Agriculture (P. I. 20460) (*197*). It was originated at Svalöf as a pure-line selection from the unselected Probsteier oat obtained originally from the Baltic region of Europe. Its origin and importance have been recorded previously (*116, pp. 122–123; 156, p. 401*). The original Golden Rain oat was selected from Probsteier (the old Milton oat) at Svalöf in 1892 by Hjalmar Nilsson.

Distribution.—Grown to some extent.

Synonyms.—Gold Rain, Golden Drop, Golden Rain II, Siberian No. 3, Svalöf Golden.

Etheridge (*61, p. 177*) described the Golden Rain type under the name of "Golden Drop" (C. I. 1790) and the abbreviated name "Gold Rain" is also sometimes used (*116, p. 122*). Golden Rain II (C. I. 4340) was originated at Svalöf, Sweden, in 1908, as a selection from a Golden Rain × Victory cross made by A. Åkerman. It differs from Golden Rain in having slightly longer and plumper grains, in ripening a few days later, and in having a thicker hull. Siberian No. 3 (C. I. 4794) is a strain of Golden Rain now being increased for distribution in Alaska. Svalöf Golden (C. I. 433) is a commercial strain of the original Golden Rain type that has become obsolete. The origin and development of these Swedish varieties have been recently reported (*156, p. 401–403*).

Tabor

Description.—Juvenile growth erect; plants late, extremely tall (140 to 200 cm.); culms midsized, rather weak, glabrous at the nodes; sheaths dark-green, usually glabrous; culm leaves midwide, margins usually glabrous; peduncles small to midsized, straight, usually fully exserted; panicles equilateral, drooping, very large, long, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches long, ascending or slightly drooping, scabrous; spikelets usually numerous, 2-flowered, rarely 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 25 mm. long, 5 to 7 mm. wide, 9- to 10-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas yellow; first lemmas midlong to long (17 to 21 mm.), glabrous; basal hairs few to several, short; awns few or absent; caryopses 8 to 10 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 109.

FIGURE 109.—Spikelets and florets of Tabor. (× 1¾.)

The most obvious character of the Tabor variety is its unusual height, which frequently is 180 to 200 cm. It also is practically awnless and is a late, unproductive, uniform spring oat. The variety may have potential value for breeding for greater forage production.

History.—Tabor (C. I. 1777) was obtained by the United States Department of Agriculture in 1917 from George M. Reed, then of the University of Missouri, who obtained it along with several other varieties from Franc Bubak, Director of the Botanical Garden at Tabor, Bohemia. Tabor was received under the name of "*Avena sativa aristata*." However, according to Körnicke and Werner (*93*) it

is *not aristata*. The variety also has been listed as "*A. sativa gigantica*."

Distribution.—None.

Synonyms.—*Avena sativa aristata*, *A. sativa gigantica*.

Yakutsk

Description.—Juvenile growth erect; plants very early, midtall (90 to 120 cm.); culms small to midsized, weak, usually glabrous at the nodes; sheaths dark-green, glabrous; culm leaves narrow to midwide, margins glabrous or slightly ciliate on lower third; peduncles small, straight, fully exserted; panicles equilateral, erect, small to midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, spreading or ascending, scabrous; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5 to 7 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains very slender; lemmas very white; first lemmas midlong to long (17 to 21 mm.), glaucous, glabrous; basal hairs few to several, short; awns few or absent; caryopses 7.0 to 8.5 mm. long; second lemmas 12 to 15 mm. long; awns absent; caryopses 5.0 to 6.5 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 110.

FIGURE 110.—Spikelets and florets of Yakutsk. (× 9/10.)

The chief distinguishing characters of Yakutsk, a spring oat, are its early maturity, very slender grains, and midlong to long, very white, glaucous lemmas. It differs from Albion and Early Champion in growing slightly taller. It is of taxonomic interest.

History.—Yakutsk (C. I. 498) was brought from Yakutsk, Siberia, in 1899 by the expedition that made the search for the explorer Andre. A sample of the original seed was obtained in 1907 from the Swedish Plant Breeding Station at Svalöf, Sweden, by N. E. Hansen (P. I. 20559, Hansen's No. 38), of the South Dakota Agricultural Experiment Station (*107*).

Distribution.—None.

Hudson

Description.—Juvenile growth erect; plants early, short to midtall (80 to 120 cm.); culms small to midsized, weak, glabrous or slightly hairy at the nodes; sheaths dark-green, usually glabrous; culm leaves narrow, margins usually glabrous; peduncles small, straight, fully exserted; panicles equilateral, erect, small to midsized, short, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises slightly flexuous, nodes 5 to 6; branches midlong, usually ascending, scabrous; spikelets few, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5 to 7 mm. wide, 9- to 10-veined, light-green and slightly glaucous before maturity; grains midplump; lemmas white; first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 7.5 to 9.0 mm. long; second lemmas 14 to 18 mm. long; awns absent; caryopses 5.5 to 7.0 mm. long; second floret rachilla segments hairy, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 111.

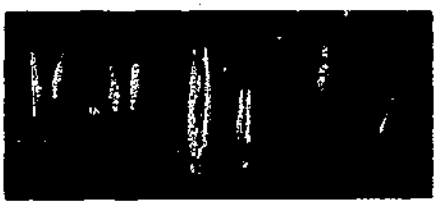


FIGURE 111.—Spikelets and florets of Hudson. (× 9/10.)

Hudson, a spring oat, differs from other early white varieties in having hairy second floret rachilla segments, little larger culms, slightly plumper grains, and in being a little taller. It also is a few days later in ripening.

History.—Hudson (C. I. 3906) originated as a selection from Sixty-Day made by W. C. Etheridge during the course of his classification studies and to which he applied the designation "Sixty-Day Selection" (*61, p. 145*).

Distribution.—Grown to a very limited extent.

Synonym.—"Sixty-Day Selection" of Etheridge.

Ajax

Description.—Ajax, a spring oat, differs from Hudson in being a little earlier,

in growing slightly taller (90 to 125 cm.), in having more ascending panicle branches, slightly plumper grains, and whiter lemmas. It has some resistance to halo blight, is resistant to many races of stem rust, and is moderately resistant to certain races of crown rust and the oat smuts.

History.—According to Welsh (*208*), Ajax (C. I. 4157, R. L. 1114, C. A. N. 660) originated from a cross between Victory and Hajira, made in 1930 at the Dominion Laboratory of Cereal Breeding, Winnipeg, Canada. Continuous plant selection was practiced with this cross until 1936, at which time the plants had reached the sixth generation. Numerous lines were increased in 1937, and the most promising of these were given a yield test at Winnipeg in 1938. R. L. 1114 was the most outstanding and was placed in the cooperative rod row tests in 1939. It performed so well, both in 1939 and in 1940, it was named and accepted for registration in 1941 in Canada. Ajax was first distributed to seed growers in the prairie Provinces of Canada in the spring of 1941.

Distribution.—Grown in Illinois, Indiana, Iowa, Maine, Michigan, Minnesota, Montana, Nebraska, New Jersey, New York, North Dakota, Ohio, South Dakota, Wisconsin, and rather widely in Canada.

Cole

Description.—Juvenile growth erect; plants early, short (60 to 90 cm.); culms small, weak, glabrous or occasionally slightly hairy at the nodes; sheaths light-green, usually glabrous; culm leaves narrow, margins usually glabrous; peduncles small, straight, usually fully exserted; panicles equilateral, erect, small, short, narrow, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 6; branches short to midlong, ascending, scabrous; spikelets few to numerous, 2-flowered or occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5 to 6 mm. wide, 8- to 9-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas white; first lemmas midlong (16 to 18 mm.), glabrous; basal hairs few to several, short; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 10 to 13 mm. long; awns absent; caryopses midlong (5 to 7 mm.); second floret rachilla segments usually glabrous, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 112.

Cole, a spring oat, is recognized by its early maturity and in having rather short slender culms, slender grains, white midlong lemmas, and very few or no awns. It is the earliest variety of white oats that has been originated as a selection from Kherson.

FIGURE 112.—Spikelets and florets of Cole. (× 1⅛.)

History.—Cole (C. I. 834) originated in 1905 as a pure-line selection from Sixty-Day at the Highmore Substation, Highmore, S. Dak., by John S. Cole, formerly of the United States Department of Agriculture and for whom the variety was named by the South Dakota Agricultural Experiment Station. Cole was first distributed to farmers in 1907. It occupied about 10 percent of the oat acreage of South Dakota in 1936 (*156, p. 385*), but it has since been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Synonym.—"Sixty-Day" of Etheridge. Etheridge described an identical almost awnless white oat under the name "Sixty-Day" (C. I. 1887) (*61, p. 145*). This strain is of no commercial importance.

Albion

Description.—Similar to Cole except for the following characters: Spikelets mostly 2-flowered; lemmas grayish-white; basal hairs few or absent; awns common, twisted and subgeniculate, 15 to 30 mm. long. Spikelets and florets are shown in figure 113.

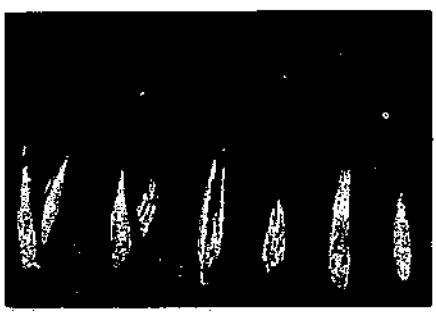


FIGURE 113.—Spikelets and florets of Albion. (× 1⅛.)

Albion, a spring oat, differs from Cole in having grayish-white lemmas and more awns. Albion usually may be differentiated from Iowar by its slightly earlier maturity and absence of color in the lower parts of the awn. Albion also has a stiffer and stronger straw than Cole.

History.—The origin of Albion (C. I. 729, Iowa No. 103) was first recorded under the designation of "Iowa No. 103" in Wallaces' Farmer (*3*), and later by others (*19*). It was developed cooperatively by the Iowa Agricultural Experiment Station and the United States Department of Agriculture as a pure-line selection from Kherson made by the late L. C. Burnett at Ames, Iowa, in 1906 and registered as an improved variety (*170*). In cooperative nursery tests, Iowa No. 103 proved to be a high-yielding, uniform, early white oat of a type needed in Iowa at that time to replace the then current unsatisfactory and highly smut-susceptible Early Champion variety. Sufficient seed of Albion was produced in 1912 for distribution to 40 Iowa farmers the next year. According to a varietal survey of 1919, Albion was grown on about 1½ million acres. The Iowa Agricultural Experiment Station estimated that more than 1,400,000 acres were planted to Albion oats in Iowa in 1924 (*80, p. 337*). It was estimated that Albion was grown on 15 percent of Iowa's oat acreage in 1935 (*156, p. 382*). Albion has been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Synonyms.—Dasix, Iowa No. 103, Nebraska No. 21, Ohio No. 7009.

Dasix (C. I. 4161, C. A. N. 656), a strain identical with Albion, was formerly grown to a very limited extent in Wisconsin. It originated at the Ontario Agricultural College, Guelph, as a selection from Sixty-Day made in 1925. Dasix was first distributed to farmers of Ontario in 1942, where it apparently has not gained much economic importance, owing to lack of disease resistance.

Nebraska No. 21 (C. I. 1371) was developed by the Nebraska Agricultural Experiment Station as a selection from Kherson. The original plant selection was made in 1909 by E. G. Montgomery and T. A. Kiesselbach. It is identical with Albion in all plant and grain characters. Nebraska No. 21 was first distributed to farmers of Nebraska in 1917, and in its day became a variety of considerable importance, especially in Nebraska. It has been almost completely replaced by disease-resistant varieties.

Ohio No. 7009, an unaccessioned oat, is a white-kerneled selection from Sixty-Day, identical in plant and grain characters with Albion, developed by the Ohio Agricultural Experiment Station. It was formerly grown to some extent, especially in Ohio, but is now of no economic importance.

White Cross

Description.—White Cross, a spring oat, differs from Albion in growing a little taller and in having slightly longer and very white lemmas.

History.—White Cross (C. I. 2026, Wisconsin No. 19) originated as a selection from a cross between Big Four (Wisconsin No. 2) and Sixty-Day, made at Madison, Wis., in 1911 by B. D. Leith. The variety was subsequently developed and distributed by the Department of Agronomy, University of Wisconsin, Madison. White Cross is registered as an improved variety (*170*) and was first distributed to farmers of Wisconsin in 1918. It was grown on 3 percent of the oat acreage of Wisconsin in 1935 (*156, p. 387*). White Cross has been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Early Champion

Description.—Similar to Cole except for the following characters: Plants short to midtall (70 to 100 cm.); branches spreading or drooping from the middle outward; glumes 18 to 21 mm. long; lemmas very white; first lemmas short to midlong (13 to 16 mm.); awns common, nontwisted to twisted and subgeniculate, 15 to 25 mm. long. Spikelets and florets are shown in figure 114.

FIGURE 114.—Spikelets and florets of Early Champion. (× 1.)

Early Champion, a spring oat, is best differentiated from Cole by its slightly later maturity, taller plants, shorter and more erect panicles with drooping branches, shorter glumes, slightly shorter, very white lemmas, and slightly less slender grains. Early Champion is highly susceptible to smut.

History.—Early Champion (C. I. 1023) was originated by Frank N. Fowler [31] in 1894 on a farm near Ames, Iowa, as a mass selection from a mixture of two varieties known locally as Burpee's Choice and Fourth of July. It was introduced to the seed trade in 1899 as a "grand new variety" by the Iowa Seed Co. (*85, p. 26*). According to Mr. Fowler, the name "Early Champion" was applied because the first year's increase of about 7 acres was harvested with a Champion binder and the variety ripened early. According to a varietal survey of 1919, Early Champion was grown on more than 650,000 acres.

Distribution.—Grown to a very limited extent.

Synonym.—Early Ohio.

Early Ohio (C. I. 1117) is a strain of Early Champion that was received from a commercial seed company of Buffalo, N. Y., in 1920.

Daubeney

Description.—Similar to Cole except for the following characters: Plants short to midtall (70 to 100 cm.); culms small to midsized, slightly more hairy at the nodes; panicles small to midsized, midbroad; branches drooping, midlong; first lemmas midlong to long (16 to 20 mm.); caryopses 8 to 10 mm. long. Spikelets and florets are shown in figure 115.

FIGURE 115.—Spikelets and florets of Daubeney. (× 1.)

Daubeney, a spring oat, has larger, longer branched, more drooping panicles, and longer lemmas than Cole. Daubeney is often confused with Early Champion, but it is less susceptible to smut.

History.—The origin of the Daubeney (C. I. 1621) oat has not been definitely determined. The following statement regarding the history of Daubeney has been obtained from the late C. A. Zavitz,[32] Ontario Agricultural College, Guelph, Canada.

In 1894, we had a group of farmers here who examined the grain of the varieties of oats which we were growing at that time. One man informed me that a neighbor of his was growing an exceptionally early variety of oats. I made arrangements to get some seed from this farmer. I was unable to get much information or to get any particular name for the oats from the farmer who was growing them whose name was Daubeney. The oats were exceptionally dirty and we got about a pound of the best seed from 10 pounds received and all of this variety which is now grown in this Province was from about 1 pound of seed which was sown here at the College in 1895 for the first time.

Distribution.—Grown to a very limited extent.

Synonym.—O. A. C. No. 3.

O. A. C. No. 3 (C. I. 1275) is a selection from Daubeney, which was developed and distributed in Canada by the Ontario Agricultural College at Guelph. It was selected in 1903 and first distributed to farmers in 1913. Those listed as having a part in the breeding of O. A. C. No. 3 include C. A. Zavitz, C. R. Klinck, W. J. Squirrel, and A. W. Mason (*156, p. 382*).

Iowa No. 444

Description.—Iowa No. 444, a spring oat, differs from Daubeney in ripening 3 or 4 days later, in growing a little taller, and in having moderate resistance to certain races of stem rust. The name "Rustless" apparently was originally applied to this oat because it appeared to escape rust to some extent even before physiologic races of the rusts were discovered.

History.—Iowa No. 444 (C. I. 2331) (*100, pp. 27–28*) originated as a selection from an oat of undetermined origin, known as Rustless, made by the late L. C. Burnett at the Iowa Agricultural Experiment Station, Ames. According to Professor Burnett, Rustless was among the varieties and strains included in the original cooperative oat nursery grown at Ames in 1906. Rustless was grown in nursery row 23, from which the plants were pulled and given Iowa station Nos. 427 to 447, inclusive. After several years of testing, all of the selections were discarded except No. 444, which appears to have been carried in the nurseries at Ames under the designation "Rustless Selection." Reselections were made from Rustless Selection and subsequently tested at Ames. One of these, designated as Iowa No. 444, was distributed to farmers of northern Iowa in 1929 (*156, p. 382*). Iowa No. 444 was grown on 1 percent of the Iowa oat acre-

[31] From a letter by George N. Fowler to M. A. Carleton, dated March 20, 1905.

[32] Letter from C. A. Zavitz, dated November 13, 1923.

age in 1929, but has since been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Synonyms.—Rustless, Rustless Selection.

Trojan

Description.—Trojan, a spring oat, differs from Danbeney in having slightly smaller culms, and resistance to some races of the oat smuts.

History.—Trojan (C. I. 2491, Sel. No. 5211–22) (*156, p. 390*) was originated as a selection from Burt made by F. A. Coffman in 1921 at the United States Akron Field Station, Akron, Colo. It may have appeared as a mechanical mixture rather than a genetic variation of Burt. Trojan was developed by the Colorado Agricultural Experiment Station and the United States Department of Agriculture.

Distribution.—Grown to some extent in Colorado, Nebraska, and South Dakota.

Gopher

Description.—Similar to Cole except for the following characters: Plants early to midseason, short to midtall (80 to 105 cm.); culms small to midsized, stiff; grains midplump. Spikelets and florets are shown in figure 116.

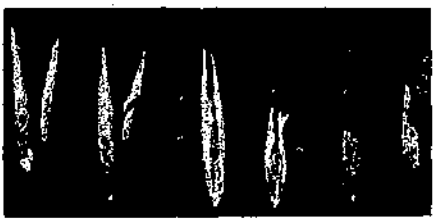


FIGURE 116.—Spikelets and florets of Gopher. (× 1⅛.)

Gopher, a spring oat, usually can be differentiated from Cole and Albion by its somewhat later maturity, taller plants, larger culms, and plumper grains. It is the stiffest strawed and one of the most productive varieties that has been originated as a selection of Kherson or Sixty-Day.

History.—Gopher (C. I. 2027, Minnesota No. 674) is a pure-line selection from Sixty-Day made at University Farm, St. Paul, Minn., in 1917 by the Minnesota Agricultural Experiment Station. The original plant selection was made and developed by H. K. Hayes and Lee Alexander. Gopher is registered as an improved variety (*170*) and was first distributed to farmers in 1923. It was grown on more than 30 percent of the oat acreage of Minnesota in 1935 (*156, p. 383*). However, it has been largely replaced by disease-resistant varieties.

Distribution.—Grown to a limited extent.

Iowar

Description.—Similar to Cole except for the following characters: Plants early to midseason, short to midtall (80 to 100 cm.); lemmas grayish-white; first lemmas midlong to long (16 to 19 mm.); awns common, usually dark-colored on lower parts, nontwisted to twisted and subgeniculate, 15 to 35 mm. long; caryopses 7 to 10 mm. long. Spikelets and florets are shown in figure 117.

FIGURE 117.—Spikelets and florets of Iowar. (× 1.)

Iowar, a spring oat, differs mainly from Cole in ripening about 4 days later and in growing 10 to 20 cm. taller. The lemmas are a little longer and the lower parts of the awns are dark-colored, which is a fairly reliable mark of identification for the differentiation of Iowar.

History.—Iowar (C. I. 847, Iowa No. 779) was selected from Kherson in 1910 by the late L. C. Burnett (*19*). Results from nursery tests of the selection in 1912, 1913, and 1914 were so favorable that it was increased and placed in field plot experiments at Ames, Iowa, in 1916. It was named and first distributed to farmers of Iowa in 1919 (*156, p. 382*) as Iowa No. 779. Iowar was developed in cooperative experiments by the Iowa Agricultural Experiment Station and the United States Department of Agriculture. It is registered as an improved variety (*170*).

In a varietal survey by the Iowa Agricultural Experiment Station in 1924, it was estimated that Iowa farmers grew nearly 800,000 acres of Iowar (*80, p. 337*). Slightly more than 10 percent of the oat acreage of Iowa was planted to

Iowar in 1935. Iowar has been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

White Bonanza

Description.—Juvenile growth erect; plants midseason, midtall to tall (100 to 150 cm.); culms midsized, weak, hairy at the nodes; sheaths light-green, hairy; culm leaves midwide, margins ciliate; peduncles small to midsized, somewhat bent, fully exserted; panicles equilateral, lax, very drooping, extremely large, long, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually flexuous, nodes 5 to 7; branches very long, drooping from the middle outward, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas white; first lemmas midlong to long (16 to 19 mm.), glabrous; basal hairs numerous, midlong to long; awns numerous, dark-colored on lower parts, twisted and geniculate, 20 to 30 mm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments hairy, long (2.5 to 3.0 mm.). Spikelets and florets are shown in figure 118.

FIGURE 118.—Spikelets and florets of White Bonanza. (× 1¼.)

White Bonanza, a spring oat, is differentiated and fairly easily identified by its extremely large, lax, drooping panicles; hairy culms at the nodes; slender grains; midlong to long lemmas; numerous twisted and geniculate awns that are dark-colored on the lower parts; and hairy second floret rachilla segments. White Bonanza is of some taxonomic interest.

History.—The origin of White Bonanza (C. I. 1686) has not been determined. The sample used in these studies was received from the Missouri Agricultural Experiment Station in 1919. It is very probable that the variety was originally forwarded to the Department of Plant Breeding at Cornell University, Ithaca, N. Y., by the United States Department of Agriculture. From the early accession records, however, it is not possible to determine as to just which variety, under the name of "White Bonanza," had been forwarded to Cornell University.

Distribution—Grown to a very limited extent.

Uton

Description.—Uton, a spring oat, differs from White Bonanza in having smaller panicles with slightly shorter and more erect branches, somewhat plumper grains, slightly less strongly twisted awns, fewer and shorter basal hairs, and less hairy rachilla segments. It also is resistant to most races of the oat smuts, which definitely separates it from White Bonanza.

History.—Uton (C. I. 3141, Utah Sel. No. 153–5–10) (*191*) originated from a cross between Markton and Swedish Select oats made by G. A. Wiebe, at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1923. In 1929 a group of selections from this cross was sent from Aberdeen to the Utah Agricultural Experiment Station at Logan, where reselections were made by D. C. Tingey. One of these reselections, because of its excellent smut resistance and high yield, was named Uton and distributed to farmers of Utah in 1937. Uton is the product of cooperative outbreeding investigations by the Idaho and Utah Agricultural Experiment Stations and the United States Department of Agriculture. It is registered as an improved variety (*154, v. 93*).

Distribution.—Grown to some extent in Utah and adjoining Intermountain States.

Canadian

Description.—Juvenile growth erect; plants midseason, light-green at time of full heading, midtall to tall (90 to 140 cm.); culms midsized to large, weak, usually glabrous at the nodes; sheaths light-green, usually slightly hairy; culm leaves midwide to wide, margins ciliate; peduncles large, occasionally slightly bent, fully exserted; panicles equilateral, slightly drooping, large, long, broad, ovate, lower whorl of panicle branches

arising at normal rachis nodes; rachises usually very flexuous, nodes 5 to 7; branches long, ascending or drooping from the middle outward, scabrous; spikelets usually numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 17 to 21 mm. long, 6 to 9 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains plump, many double; lemmas yellowish-white to white; first lemmas short (13 to 15 mm.), depressed dorsum, glabrous; basal hairs few or absent; awns few to common, not dark-colored on the lower parts, nontwisted to twisted and subgeniculate, 10 to 25 mm. long; caryopses 7 to 9 mm. long; second lemmas 6 to 11 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 119.

FIGURE 119.—Spikelets and florets of Canadian. (× ⅞.)

Canadian, a spring oat, is easily distinguished by its large, slightly drooping, long-branched panicles, and plump grains of which many are double. The double grains give the spikelets a single-grain appearance of barley; hence, the name "Barley Oat." Canadian is characterized by high susceptibility to nearly all the physiologic races of the oat smuts; therefore, it has been replaced by disease-resistant varieties.

History.—The origin of Canadian (C. I. 1625) in the United States is undetermined. It probably was first introduced into America from England or Scotland nearly a century ago under the name of "Barley Oat," or "Potato Oat." Canadian is a very old variety, and there is no definite information available on its early culture in the United States. Strains of the old Barley Oat have been grown in Europe for centuries.

Distribution.—Grown to a very limited extent.

Synonyms.—Barley Oat, Potato, Potato Oat.

The name "Potato" was applied to the progeny of a single plant of Canadian found in a potato field in England more than a century ago. Several strains of the variety are still grown in England and Scotland.

Early Mountain

Description.—Similar to Canadian except for the following characters: Panicles midsized to large; glumes 20 to 26 mm. long; grains slender to midplump, few or none double; first lemmas midlong (16 to 18 mm.), without depressed dorsum; basal hairs few to several, short; awns 15 to 30 mm. long; caryopses 7 to 9 mm. long. Spikelets and florets are shown in figure 120.

FIGURE 120.—Spikelets and florets of Early Mountain. (× 3.)

Early Mountain, a spring oat, differs from Canadian primarily in having smaller panicles, longer lemmas, and few or no double grains or bosom oats, and usually many fewer awns. The grains also are more slender. The very light green of the plants and glumes at time of full heading is usually even more apparent than in Canadian.

History.—Early Mountain (C. I. 1624) was imported about 1901 from Castle Farm, Oberröslau, Unterröslau, Bavaria, Germany, by John Yeggen, a farmer living near Bismarck, N. Dak. Several selections have been made from it of which the most important are Early Mountain No. 2 and Early Mountain No. 8. Only 7,631 acres of Early Mountain were reported in the varietal survey of 1919.

Distribution.—Grown to a very limited extent.

Synonyms.—Early Mountain No. 2, Early Mountain No. 8.

Marion

Description.—Juvenile growth erect; plants midseason, light-green at time of full heading, midtall (90 to 115 cm.); culms small to midsized, weak, hairy at the nodes; sheaths light-green, glabrous or slightly hairy; culm leaves narrow to midwide, margins glabrous or occasionally ciliate on lower third; peduncles

small to midsized, straight, fully exserted; panicles equilateral, usually slightly drooping, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes, rachises slightly flexuous, nodes 4 to 6; branches midlong, drooping from the middle outward, scabrous; spikelets few to numerous, usually 2-flowered, occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, usually 9-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas white (ivory-white); first lemmas midlong to long (17 to 20 mm.), glabrous; basal hairs few to several, short; awns few to common, nontwisted to twisted and subgeniculate, 20 to 30 mm. long; caryopses 8 to 10 mm. long; second lemmas 12 to 18 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 121.

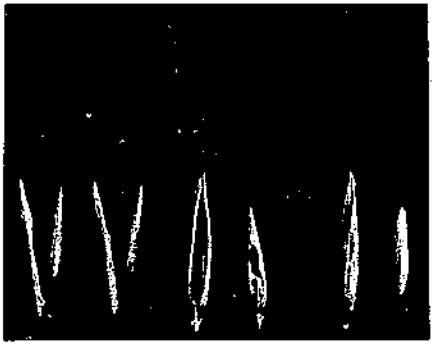


FIGURE 121.—Spikelets and florets of Marion. (× 1.)

Marion, a spring oat, is distinguished by its characteristically light-green color of the plants and glumes during the heading stage. Its ivory-white, thin-hulled, midlong to long lemmas, and slender to midplump grains with large groats afford additional marks of identification. Marion is resistant to many races of stem rust and the oat smuts and moderately resistant to certain races of crown rust.

History.—Marion (C. I. 3247) (*36; 166, pp. 3–4*) originated from the same Marion-Rainbow cross that gave rise to Hancock. This cross was made by F. A. Coffman at Arlington Farm, Rosslyn, Va., in 1928. The selection, later named "Marion," was tested for disease resistance and yield in cooperative experiments by the United States Department of Agriculture, and the Iowa and Idaho Agricultural Experiment Stations. It was registered as an improved variety (*154, v. 32*). It was first distributed to farmers of Iowa in 1940.

Distribution.—Grown mostly in Illinois, Iowa, Michigan, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin.

Danish Island

Description.—Juvenile growth erect; plants midseason, light-green at time of full heading, short to midtall (60 to 110 cm.); culms midsized, stiff, slightly hairy at the nodes; sheaths light-green and glaucous before maturity, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, usually slightly drooping, midsized, midlong to long, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises flexuous, nodes 5 to 7; branches midlong, ascending or drooping from the middle outward, scabrous; spikelets numerous, 2- or 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas reddish-yellow to white (creamy-white); first lemmas long (19 to 21 mm.), slightly glaucous, glabrous; basal hairs few to several, midlong; awns, common, nontwisted to twisted and geniculate, 20 to 30 mm. long; caryopses 8 to 10 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 122.

FIGURE 122.—Spikelets and florets of Danish Island. (× 1.)

Danish Island, a spring oat, has more drooping panicles and more awns and is a little earlier in maturity than Scottish Chief. Its lemmas are also less glaucous and more of a reddish yellow to white (creamy white) than Scottish Chief, resembling O. A. C. 144 in lemma color,

The whole plant is of a lighter green at the time of full heading than either Scottish Chief or Gothland.

History.—The source of Danish Island (C. I. 1684) used in these studies has not been determined. The name "Danish Island" has been applied to several types of oats. Newman (*116, pp. 119–130*) reported that the true Danish Island oat is the same as the unselected Probsteier variety that was obtained originally from the Danish Islands by the Swedish Plant Breeding Station, Svalöf, Sweden. The W. Atlee Burpee & Co. (*20, 1904, p. 104*), introduced a type of oats under the name of "Danish Island" from Denmark in 1895 that was identified in these studies as Awnless Probsteier.

Distribution.—Grown to a very limited extent.

Tobolsk

Description.—Juvenile growth erect; plants midseason, dark-green at time of full heading, short to midtall (70 to 120 cm.); culms midsized, stiff, usually glabrous at the nodes; sheaths dark-green, usually glabrous; culm leaves midwide, margins glabrous; peduncles small, straight, fully exserted; panicles equilateral, drooping, midsized, midlong, broad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 4 to 7; branches long, drooping from the middle outward, scabrous; spikelets few to numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 24 mm. long, 6 to 8 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas white; first lemmas short (13 to 15 mm.), glabrous; basal hairs few to several, short to midlong; awns common, usually dark-colored on lower parts, nontwisted to twisted and subgeniculate, 10 to 35 mm. long; caryopses 6 to 9 mm. long; second lemmas 8 to 11 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 123.

Tobolsk, a spring oat, is best differentiated from Early Mountain by its larger and more drooping panicles with very drooping branches, short lemmas, and sparsely hairy second floret rachilla segments.

History.—Tobolsk (C. I. 1769) was introduced into the United States in 1899 from the Tobolsk Government of Russia by the late M. A. Carleton, of the United States Department of Agriculture (P. I. 2800 and 4341) (*197*). Only 1,330 acres of Tobolsk were reported in the varietal survey of 1919 and by now the variety is probably almost obsolete.

FIGURE 123.—Spikelets and florets of Tobolsk. (× 1½.)

Distribution.—Grown to a very limited extent.

Synonyms.—Alaska, Early Siberian.

Alaska (C. I. 230) is a strain of Tobolsk that apparently was placed on the market for the first time by the L. L. Olds Seed Co., of Madison, Wis., in 1904 (*122, p. 19*). It never attained much economic importance.

Early Siberian (C. I. 307) probably is an earlier introduction of the Tobolsk variety than the one introduced by Carleton and of even less agronomic importance.

DeWitt

Description.—Juvenile growth erect; plants midseason, dark-green at time of full heading, midtall (90 to 120 cm.); culms midsized, stiff, usually slightly hairy at the nodes; sheaths dark-green, usually glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, drooping, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, ascending or drooping from the middle outward, scabrous; spikelets numerous, usually 2-flowered or occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 6 to 8 mm. wide; 9- to 11-veined, light-green, and somewhat glaucous before maturity; grains midplump to plump; lemmas white; first lemmas midlong (16 to 18 mm.), glabrous; basal hairs several, long; awns numerous, dark-colored on the lower parts, twisted and geniculate, 15 to

35 mm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segment glabrous, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 124.

FIGURE 124.—Spikelets and florets of DeWitt. (× 1.)

DeWitt, a spring oat, is differentiated by its ever-present long basal hairs. It is distinguished from Tobolsk and Canadian by having longer lemmas and more awns and by being consistently and decidedly dark-colored on the lower parts.

History.—DeWitt (C. I. 1894) was selected from Silvermine by Etheridge (*61, p. 149*) during the course of his classification studies, who for the want of a better name designated it as "Silvermine Selection." No information is available as to the particular strain of Silvermine from which he made the selection.

Distribution.—Grown to a very limited extent.

Synonym.—"Silvermine Selection" of Etheridge.

O. A. C. No. 72

Description.—Juvenile growth erect; plants midseason, dark-green at time of full heading, midtall to tall (100 to 130 cm.); culms midsized to large, hairy at the nodes; sheaths light-green, glabrous or slightly hairy; culm leaves midwide, margins glabrous or slightly ciliate on lower third; peduncles midsized, straight, fully exserted; panicles equilateral, usually erect, midsized to large, long, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises very flexuous, nodes 5 to 7; branches long, drooping from the middle outward, scabrous; spikelets numerous, usually 2-flowered, occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 5.5 to 7.5 mm. wide, 9- or 10-veined, light-green and somewhat glaucous before maturity, reddish-green at maturity; grains slender to midplump; lemmas reddish-yellow to white (creamy-white); first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs several, short to midlong; awns common, nontwisted to twisted and subgeniculate, 20 to 28 mm. long; caryopses 8 to 10 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 6.5 to 8.5 mm. long; second floret rachilla segments usually glabrous, midlong (2 to 2.5 mm.). Spikelets and florets are shown in figure 125.

FIGURE 125.—Spikelets and florets of O. A. C. No. 72. (× 1⅛.)

O. A. C. No. 72, a spring oat, is recognized mainly by its midtall to tall plant, midsized to large culms; large, long branches, usually erect panicles; reddish, light-colored glumes and lemmas; midlong to long lemmas; and slender to midplump awned grains. The reddish-yellow to white, or copperish color of the whole plant at maturity, including the ripened lemmas which Derick (*47, p. 18; 50, p. 18*) described as creamy white, is probably its most outstanding mark of identification.

History.—The origin of O. A. C. No. 72 (C. I. 846) in North America, according to the late C. A. Zavitz, of the Ontario Agricultural College, Guelph, Canada, is as follows: [22]

> In the early spring of 1889, we obtained two varieties of oats both under the name of Siberian. One we obtained from Siberia and the other from France. The French variety gave rather poor results and we dropped it after a few years. The Siberian from Russia we are still growing and it was this material which we used in a large nursery plot. The O. A. C. No. 72 originated from one of the individual plants selected from this lot.

[22] Letter from C. A. Zavitz, dated November 18, 1923.

O. A. C. No. 72 was formerly grown to some extent in Canada, especially in the eastern provinces.

Distribution.—Grown to a very limited extent.

Synonym.—Siberian.

O. A. C. No. 144

Description.—Similar to O. A. C. No. 72 except for the following characters: Plants midtall to tall (90 to 150 cm.); culms large, glabrous or slightly hairy at the nodes; panicles usually very erect, large; branches ascending; awns few or absent; second floret rachilla segments sparsely hairy, long (2.5 to 3.0 mm.). Spikelets and florets are shown in figure 126.

FIGURE 126.—Spikelets and florets of O. A. C. No. 144. (× 1¼.)

O. A. C. No. 144, a spring oat, can be differentiated from O. A. C. No. 72 by its more erect panicles and few or no awns. The culms also under most conditions are noticeably taller and slightly larger. It is a rather distinct variety, although, like O. A. C. No. 72, it is somewhat variable. Zavitz (*214, p. 4*) stated that O. A. C. No. 144 is a tall, vigorous, broadleaved, stiff-strawed, late variety of oats, which possesses a spreading panicle and long, slightly reddish-yellow lemmas of good quality. Derick (*47, p. 15; 50, p. 21*) also described O. A. C. No. 144.

History.—O. A. C. No. 144 (C. I. 2476) originated as a selection from O. A. C. No. 72 made at the Ontario Agricultural College, Guelph, Canada, in 1923. Those having a part in its development were C. R. Klinck, C. A. Zavitz, W. J. Squirrel, and A. W. Mason (*156, p. 388*). The number 144 was derived by doubling 72. According to Zavitz (*214*), it is a new and even better variety than O. A. C. No. 72. O. A. C. No. 144 was distributed to farmers in Ontario for the first time in the spring of 1923, where it was grown to some extent.

Distribution.—Grown to a limited extent.

Scottish Chief

Description.—Juvenile growth erect; plants midseason, dark-green at time of full heading, short to midtall (70 to 120 cm.); culms midsized, stiff, usually slightly hairy at the nodes; sheaths dark-green and very glaucous before maturity, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, erect, midsized, midlong to long, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises flexuous, nodes 5 to 7; branches midlong, ascending or drooping from the middle outward, scabrous; spikelets numerous, 2- or 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and glaucous before maturity, widespreading (flaring) at maturity; grains slender to midplump; lemmas white; first lemmas midlong to long (17 to 21 mm.), glaucous, glabrous; basal hairs few or absent; awns few or absent; caryopses 8 to 10 mm. long; second lemmas 12 to 16 mm. long, awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 127.

FIGURE 127.—Spikelets and florets of Scottish Chief. (× 1.)

The principal distinguishing character of Scottish Chief, a spring oat, is the widespreading (flaring), very white glumes at maturity. Its slightly smaller panicles with more ascending branches also helps to distinguish it from varieties such as Gothland, while its midlong to long lemmas separate it from Belyak, Swedish Select, and Victory.

History.—Scottish Chief (C. I. 1699) probably was first introduced from Scotland as early as 1885 or earlier (*22, pp. 149–151; 65, p. 73*) and apparently was first distributed by the J. A. Everitt & Co., Indianapolis, Ind. Another record indicates that a parcel of seed of the variety was brought over from Scotland in 1900 by the L. L. May & Co., a seed

firm of St. Paul, Minn., (*108*). This strain is said to have been grown in the Highlands of Scotland for many decades.

Distribution.—Grown to a very limited extent.

Synonyms.—English Wonder, Isbell's New Johnson, Johnson, Michigan Wonder, New Johnson, Scottish Chieftain.

The English Wonder (C. I. 223), a strain of Scottish Chief, apparently was introduced to the trade by the Harry N. Hammond Seed Co., Ltd., of Bay City, Mich. (*68, p. 55*). There appears to be no authentic record regarding its origin. Isbell's New Johnson (C. I. 1255) is a strain of Scottish Chief placed on the market by the S. M. Isbell & Co., of Jackson, Mich., (*86*) in 1905. Johnson (C. I. 1608) appears to be the same oat that was later called New Johnson. Michigan Wonder also appeared to have been sold by the Hammond Co. (*68*). According to the L. L. Olds Seed Co., of Racine, Wis. (*122*), this name was applied by a Mr. Johnson of Michigan, who improved it by selection. Scottish Chieftain is the name used for Scottish Chief by Marquand (*107, p. 24*).

Upright

Description.—Upright, a spring oat, differs from Scottish Chief in growing 10 to 20 cm. taller, in having slightly plumper grain and slightly more awns.

History.—Upright (C. I. 2142) originated in 1914 at Ithaca, N. Y., as a pure-line selection from a variety known as American Beauty, obtained from Jefferson County, N. Y., made and developed by the Department of Plant Breeding, Cornell University, in cooperation with the United States Department of Agriculture. Upright is registered as an improved variety (*170*). It was first distributed to farmers of New York in 1918. About 10 percent of the oat acreage of New York in 1935 was planted to Upright (*156, p. 383*). Since then the variety has been replaced by disease-resistant oats.

Distribution.—Grown to a very limited extent.

Irish Victor

Description.—Similar to Scottish Chief except for the following characters: Basal hairs few to several, short; awns common, twisted and geniculate, 20 to 30 mm. long. Spikelets and florets are shown in figure 128.

Irish Victor, a spring oat, has more awns and slightly less erect panicles, and does not show the characteristic spreading or flaring glumes at maturity of Scottish Chief.

FIGURE 128.—Spikelets and florets of Irish Victor. (× ⅔.)

History.—Irish Victor (C. I. 2094) was introduced to the trade as a grand new oat novelty in 1900 by the Iowa Seed Co., Des Moines, Iowa (*85, 1900, p. 33*). This company reports that it was brought over from Ireland in 1897. No further details are available concerning the origin of Irish Victor.

Distribution.—Grown to a very limited extent.

Maine No. 340

Description.—Maine No. 340, a spring oat, differs from the original Irish Victor in growing slightly less tall and in having a little shorter lemmas and plumper grains.

History.—Maine No. 340 (C. I. 1802) originated as a pure-line selection made by F. M. Surface and Jacob Zinn in 1916 at the Maine Agricultural Experiment Station, Orono. It was first distributed to farmers in 1916 and was grown on 75 percent of the oat acreage of Maine in 1935, and to some extent in other New England States.

Distribution.—Grown to some extent.

Gothland

Description.—Similar to Scottish Chief except for the following characters: Glumes 22 to 28 mm. long; grains very slender; lemmas very white; first lemmas long to very long (19 to 22 mm.), very glaucous; basal hairs several, short; awns common, nontwisted to twisted and subgeniculate, 20 to 35 mm. long; caryopses 8.0 to 9.5 mm. long; second floret rachilla segments hairy or sparsely hairy. Spikelets and florets are shown in figure 129.

Gothland, a spring oat, is differentiated by having long to very long glumes and lemmas and slightly hairy second floret rachilla segments. At maturity, the lemmas also are of a distinct very glaucous white, which, when not discolored by weather, serves further to identify the variety.

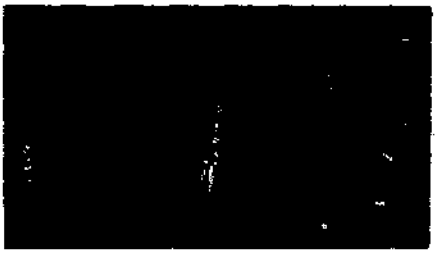


FIGURE 129.—Spikelets and florets of Gothland. (× 1.)

History.—The origin of Gothland (C. I. 1898) has not been determined. However, it is believed to have been obtained originally from Sweden about 1890 by an experiment station in Canada.

Distribution.—Grown to a very limited extent.

Minnesota No. 295

Description.—Minnesota No. 295, a spring oat, differs from Gothland in ripening a little earlier and in having slightly shorter lemmas.

History.—Minnesota No. 295 (C. I. 1290) was originated at the Minnesota Agricultural Experiment Station, St. Paul.

Distribution.—Grown to a very limited extent.

Belyak

Description.—Juvenile growth erect; plants midseason, very glaucous at time of full heading, midtall to tall (90 to 130 cm.); culms midsized to large, stiff, usually glabrous at the nodes; sheaths dark-green, glaucous, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, erect, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, mostly ascending, scabrous; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 19 to 24 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains very plump; lemmas white; first lemmas short to midlong (14 to 17 mm.), depressed dorsum, very glaucous, glabrous; basal hairs few or absent; awns few or absent; caryopses 6.5 to 8.0 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 6.0 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 130.

FIGURE 130.—Spikelets and florets of Belyak. (× 1⅛.)

The outstanding distinguishing character of Belyak, a spring oat, is the conspicuous heavy glaucousness, or waxy bloom, that covers the entire plants at about the time of full heading. Even at maturity the bloom often is still noticeable on the upper ends of the lemmas. Under some conditions similar varieties, such as Swedish Select and Victory, also develop considerable glaucousness, but, as a rule, it is not so marked as in Belyak.

History.—Belyak (C. I. 1630) was introduced from Moscow, Russia, in 1904, by the United States Department of Agriculture (P. I. 10624) (*197*) as being "especially valuable for regions of limited rainfall." Belyak was originally brought to Moscow from the Swedish Plant Breeding Station at Svalöf, Sweden, and is said to have originated as a selection from Swedish Select. Belyak was apparently reported as Swedish Select in the varietal survey of 1919.

Distribution.—Grown to a very limited extent.

Synonym.—White Belyak.

Swedish Select

Description.—Juvenile growth erect; plants midseason, slightly glaucous at time of full heading, midtall to tall (90 to 130 cm.); culms midsized to large, stiff, usually slightly hairy at the nodes; sheaths dark-green, slightly glaucous, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles equilateral, erect, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, mostly ascending, scabrous; spikelets few to numerous, usually about 50 percent 3-flowered, separating by fracture; florets separating by disarticulation; glumes 19 to 24 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and slightly glaucous before maturity; grains very plump; lemmas white, with depressed dorsum; first lemmas short to midlong (14 to 17 mm.), slightly glaucous, glabrous; basal hairs

few or absent; awns common to numerous, dark-colored on the lower parts, twisted and subgeniculate to geniculate, 15 to 35 mm. long; caryopses 6.5 to 8.0 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 6.0 long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 131.

FIGURE 131.—Spikelets and florets of Swedish Select. (×⅝.)

Swedish Select, a spring oat, differs mainly from Belyak in being decidedly less glaucous, in having more 3-flowered spikelets and more distinctly concave lemma (depressed dorsum) in the region of the awn with numerous twisted and subgeniculate to geniculate awns that are dark-colored on the lower parts.

History.—Swedish Select (C. I. 134) is said to have originated as a selection from the Ligowo oat. It apparently was introduced from Sweden into Finland and the St. Petersburg (Petrograd) Province of Russia. The late M. A. Carleton, of the United States Department of Agriculture, explored Russia in 1898 and 1899 for disease-resistant small grains and introduced Swedish Select into the United States (P. I. 2788) (*197*). Carleton (*25, p. 7*) reported that it was obtained from the cold and semiarid slopes of the Province of St. Petersburg. Another official introduction of this variety (P. I. 9422) was made in 1903 by E. A. Bessey, of the University of Nebraska, Lincoln, from Moscow, Russia.

Distribution.—Grown to a limited extent.

Synonyms.—American Beauty, Clydesdale, Dibble Heavyweight, Ligowa, Ligowo, Ligowo II, Ligowo Giant, Ligowo White, Minnesota No. 6, Montana No. 30, Mortgage Lifter, Myrick, National, New Market, Regenerated Swedish Select, Roosevelt, Sensation, Shadeland Climax, Sovereign, Thousand Dollar, White President, White Siberian, Wideawake, Wisconsin Pedigree No. 5.

According to S. F. Leonard, Chicago, Ill. (*99, p. 68*), American Beauty oat (C. I. 163) was developed as a selection by O. H. Alexander of Vermont during the middle nineties. The original seed was received from Russia. This strain was formerly grown to some extent in Canada, but it is now nearly obsolete in the United States.

Clydesdale (C. I. 1626) was introduced into the United States from Scotland in 1895 by Peter Henderson & Co., Philadelphia, Pa. (*73*). A sample of seed of this oat was received from Russia in 1900. Additional samples (P. I. Nos. 42089 and 48104) (*197*) were received from A. E. V. Richardson, of the Department of Agriculture, Victoria, Australia, in 1916 and 1917, respectively. Clydesdale, for some reason, never met with the success in its day that followed the introduction of the similar or identical oat under the name "Swedish Select" by Carleton. Clydesdale is now of little importance, being largely replaced by disease-resistant varieties.

"Dibble Heavyweight" (C. I. 1369) is a name applied to a strain of Swedish Select sold by a commercial seedsman of Honeoye Falls, N. Y. This strain is still grown to a limited extent in New York.

Ligowo, sometimes spelled Ligowa, was originated by Vilmorin, of Paris, France, from where it was introduced into Sweden in the nineties (*116, p. 123*). It is said to have been reselected by the Swedish Plant Breeding Station at Svalöf, Sweden. Introductions of Ligowo oats have been received by the United States Department of Agriculture from the following sources: Svalöf, Sweden (P. I. 5471 and 20459); New South Wales (P. I. 21390); Bucharest, Rumania, (P. I. 25585); Wurzburg, Bavaria, (P. I. 25749); Feuchtwangen, Germany, (P. I. 26228); and Podolia, Russia, (P. I. 28586) (*197*).

Ligowo Giant (C. I. 1926), Ligowo II (C. I. 1924), Ligowo White (C. I. 2812), and Minnesota No. 6 (C. I. 506) are similar or identical strains of the Swedish Select type. The breeding of Ligowo II is recorded (*156, p. 401*).

Montana No. 30, unaccessioned, is a selection from Swedish Select, developed by the Montana Agricultural Experiment Station, Bozeman. It was distributed to a limited extent in Montana, but it is now obsolete, having been replaced by Victory and such smut-resistant varieties as Bridger and Mission.

Mortgage Lifter (C. I. 1661) is a strain of Swedish Select placed on the market by a commercial seed company of Portland, Oreg. This strain likewise has become nearly obsolete.

The Myrick (C. I. 739) strain probably was first placed on the market by Northrup, King & Co., of Minneapolis, Minn., (*119*). Details on its origin with that

company are undetermined and the variety is now of no economic importance.

National (C. I. 767) is a strain of Swedish Select placed on the market in 1906 by the L. L. Olds Seed Co. (*122, 1906 p. 9*). National was formerly grown rather widely in the upper Mississippi Valley as a result of extensive advertising by the introducer. In 1907 the J. A. Salzer Seed Co. listed National in their seed catalog (*138, 1907, p. 105*). However, improved disease-resistant varieties of known breeding have replaced it.

New Market (C. I. 1277), a strain of Swedish Select, was developed by Webb & Sons of England and is a well-known agricultural variety in the British Isles. It is rarely grown in the United States.

Regenerated Swedish Select (C. I. 1291) takes its name from the regeneration process that is supposed to follow by crossing a variety within itself, or the so-called intervarietal crossing. Garton's Ltd., of England, introduced the Regenerated Swedish Select and claimed that it was superior to the original Swedish Select. However, numerous comparable data from varietal experiments do not show any improvement in yield or change in plant characters. This strain is now little grown in the United States.

Roosevelt (C. I. 752) is a strain of Swedish Select sold by a commercial seed company of Faribault, Minn., but no information is available concerning its breeding. This strain is now of little economic importance.

The Sensation (C. I. 246) oat apparently was first placed on the market in 1903 by a commercial seed company and is now seldom grown.

Shadeland Climax (C. I. 681), a selection of the Swedish Select type developed by N. C. Nairn, a private breeder located at Amity, Oreg., apparently was first placed on the market by a commercial seed company of Portland, Oreg., about 1910. Shadeland Climax is still grown to some extent in western Oregon and Washington, where it has been a very productive variety in the absence of rust.

Sovereign (C. I. 3628), a strain of the Swedish Select type, was received from R. A. Derick, Central Experimental Farm, Ottawa, Canada. It originated as a plant selection from an unnamed variety on the Island of Falster, Denmark. Sovereign is somewhat variable in certain plant and grain characters. It has not been of any economic value in the United States.

Thousand Dollar (C. I. 2489), a strain of the Swedish Select type, was formerly grown in Canada, where it apparently was first introduced from Cambridge, England, about 1904. Thousand Dollar may be still grown to a very limited extent in Canada but is nearly obsolete in the United States.

White President (C. I. 1549), a strain of Swedish Select apparently first distributed about 1920 by a commercial seed company of Sugar Grove, Ill., is now of little or no economic importance.

White Siberian (C. I. 741), the strain of Swedish Select known as Siberian and sometimes confused with the mixed population from which O. A. C. No. 72 was selected, appears to have been an importation made in 1888 from Haage & Schmidt, Erfurt, Germany, by the Ontario Agricultural College, Guelph, Canada. It was formerly grown to some extent in North Dakota, but it is now nearly obsolete.

Wideawake (C. I. 1648) is an old agricultural variety, which probably was renamed "Lincoln," and its origin is not certain. In all probability it was brought over by the Swedish immigrants who settled in Wisconsin in the 1880's or earlier. It is now grown on only a few farms in the upper Mississippi Valley States. According to a varietal survey in 1919, Lincoln was reported as grown on about 136,000 acres.

Wisconsin Pedigree No. 5 (C. I. 1054) was developed by the Wisconsin Agricultural Experiment Station. Leith and Delwiche (*98, p. 8*) recorded its history as follows:

> One of the oldest and best known of the oat varieties in Wisconsin is the Pedigree No. 5. This is a pure line selection from the Swedish Select. The original stock from which this selection was made was obtained from the United States Department of Agriculture in 1898. Several selections were made and bred up by the centgener method and finally Pedigree No. 5 was found to be superior to its competitors.

The original Wisconsin No. 5 plant selection was made in 1905 by R. A. Moore and A. L. Stone. It occupied about 3 percent of the oat acreage of Wisconsin in 1935 (*156, p. 387*). It has been almost completely replaced by disease-resistant varieties.

Abundance

Description.—Abundance, a spring oat, differs slightly from Swedish Select in ripening a little earlier and in usually having fewer awns.

History.—Abundance oat (C. I. 3203) was bred by Garton's Ltd., of Warrington, England. It is said to be the result of a selection from a cross between the White August and White Swedish oats. Abundance was first

placed on the market in England in 1892, and apparently it was first introduced into the United States from Indian Head, Canada. It also was received from the Wagga Experiment Station, New South Wales, in October 1907 (P. I. 21392) (*197*). Many other lots of seed of Abundance have been imported into North America by seedsmen and private individuals.

Distribution.—Grown to a limited extent in Oregon and Washington.

Colorado No. 37

Description.—Colorado No. 37, a spring oat, differs from Swedish Select in having fewer awns and in being slightly shorter and more uniform in plant height.

History.—Colorado No. 37 (C. I. 1640) was selected in 1900 from a field of commercial oats on the farm of P. A. Amiss at La Garita, in the San Luis Valley of southwestern Colorado, by A. H. Danielson, formerly of the Agronomy Section, Colorado Agricultural College, Fort Collins. This institution subsequently developed and distributed the variety under the supervision of Alvin Kezer. Colorado No. 37 is registered as an improved variety (*170*) and was first distributed to Colorado farmers about 1920, primarily for growing on irrigated land. However, according to the Barteldes Seed Co. (*11*), this oat was developed by the Colorado Experiment Station by hybridization and selection that involved several varieties. This breeding was started about 1900, each year the undesirable types were eliminated and No. 37 was finally selected in 1906 by W. H. Olin. Colorado No. 37 was first listed and sold as a novelty by the Barteldes Seed Co. in 1911. It was grown on 75 percent of the oat acreage of Colorado in 1935 (*156, p. 381*), and the percentage apparently has remained about the same.

Distribution.—Grown extensively in Colorado and to a limited extent under irrigation in several other Rocky Mountain States.

Lincoln

Description.—Lincoln, a spring oat, differs slightly from Swedish Select in having fewer 3-flowered spikelets, little longer lemmas, and slightly more slender grain with a less depressed dorsum and usually fewer awns.

History.—Lincoln (C. I. 1262) was introduced to the seed trade in 1894 as an agricultural wonder by the then Northrup, Braslan & Goodwin Co. of Minneapolis, Minn. (*118, p. 39; 179, p. 44*).

The origin of the strain to which the name "Lincoln" was applied by the seed company at Minneapolis has not been determined.

Distribution.—Grown to a limited extent.

Miami

Description.—Miami, a spring oat, differs from Swedish Select in ripening a little earlier, in having a slightly shorter and larger straw, and in having more awns.

History.—Miami (C. I. 2245, Ohio No. 6203) originated at the Ohio Agricultural Experiment Station, Wooster, as a pureline selection from a variety being grown under the name of "Siberian." The original plant selection was made by C. G. Williams in 1906. It was first distributed to farmers in 1912, and was named in 1922 and registered as an improved variety (*169*). About 20 percent of the oat acreage of Ohio was sown to Miami in 1935 (*156, p. 384*), but Miami has since been largely replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Overland

Description.—Juvenile growth erect; plants midseason, slightly glaucous at time of full heading, short to midtall (70 to 100 cm.); culms small to midsized, stiff, usually glabrous at the nodes; sheaths dark-green, usually glabrous; culm leaves narrow to midwide, margins usually glabrous; peduncles small to midsized, straight, usually fully exserted; panicles equilateral, erect, small, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 4 to 6; branches short to midlong, mostly ascending, scabrous; spikelets usually few, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 16 to 22 mm. long, 5 to 7 mm. wide, 9- to 11-veined, light-green and glaucous before maturity; grains plump; lemmas white; first lemmas short (12 to 15 mm.), glabrous; basal hairs few or absent; awns few to common, nontwisted to twisted and subgeniculate, 10 to 20 mm. long, not dark-colored on lower parts; caryopses 6 to 9 mm. long; second lemmas 8 to 11 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 132.

Overland, a spring oat, is rather distinct in having short, stiff culms; rather small, stiff erect panicles; short lemmas; and plump grains. The awns are shorter and weaker than in Wayne. Because of the short, stiff straw, Overland makes an excellent companion crop on irrigated

FIGURE 132.—Spikelets and florets of Overland. (× 1¼.)

land for clover and alfalfa seedings. It is resistant to many races of the oat smuts and to some races of crown and stem rust, but it is susceptible to Victoria blight.

History.—Overland (C. I. 4181) originated from a cross between a Victoria-Richland selection and Bannock made at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, by F. A. Coffman in 1934. Numerous selections were made and tested at the branch station, Aberdeen, and other State agricultural experiment stations in the Pacific Northwest under the direction of Harland Stevens. One of these selections proved to be outstanding for yield, quality of grain, and smut resistance. It was later named "Overland" and was first distributed to farmers of southern Idaho in 1947. Overland was developed cooperative by the Idaho Agricultural Experiment Station and the United States Department of Agriculture and registered (*154, p. 44*).

Distribution.—Grown in Idaho, Montana, Oregon, Utah, and Washington.

Wayne

Description.—Juvenile growth erect; plants midseason, slightly glaucous at time of full heading, short to midtall (70 to 100 cm.); culms midsized, stiff, usually glabrous at the nodes; sheaths dark-green, glaucous, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, erect, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, mostly ascending; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 19 to 24 mm. long, 5 to 8 mm. wide, 9- to 10-veined, light-green and slightly glaucous before maturity; grains slender to midplump; lemmas white; first lemmas short (12 to 15 mm.), without depressed dorsum, glabrous; basal hairs few or absent; awns numerous, twisted and subgeniculate to geniculate, 15 to 30 mm. long, dark-colored on lower parts; caryopses 6.5 to 8.0 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 6.0 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 133.

FIGURE 133.—Spikelets and florets of Wayne. (× 1.)

Wayne differs from Belyak in being earlier in maturity, in having less glaucous plants and numerous awns that are twisted and subgeniculate to geniculate, usually dark-colored on lower parts. As compared with Silvermine it ripens 2 to 4 days earlier and under most conditions grows a little shorter and has many more awns.

History.—Wayne (C. I. 2567, Ohio Hybrid No. 9673) was originated at the Ohio Agricultural Experiment Station, Wooster, as a selection made in 1909 from a hybrid of which the parents are unknown. The selection was subsequently tested by C. G. Williams, L. E. Thatcher, A. D. Shelby, and others. Wayne was first distributed to farmers in 1930 (*156, p. 384*). It is registered as an improved variety (*169*). It was grown on more than 20 percent of the oat acreage in Ohio in 1935, but has since been replaced by improved disease-resistant varieties.

Distribution.—Grown to a limited extent in Indiana, Michigan, and Ohio.

Legacy

Description.—Legacy, a spring oat, differs from Wayne in having fewer awns and slightly more slender grains. It has no resistance to the rusts and smuts.

History.—Legacy (C. I. 2474) was developed from a cross between Banner and a variety known as Eighty-Day by the Cereal Division, Central Experimental Farm, Ottawa, Ontario, Canada (*50, p. 26*). The cross was made in 1906, and the selection, later named "Legacy," was distributed to farmers in 1920 and

accepted for registration in Canada in 1934.

Distribution.—Grown to a very limited extent both in the United States and in Canada, but has been replaced by disease-resistant varieties.

Silvermine

Description.—Juvenile growth erect; plants midseason, slightly glaucous at time of full heading, midtall to tall (100 to 130 cm.); culms midsized, stiff, slightly glaucous, usually glabrous at the nodes; sheaths dark-green, slightly glaucous, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, erect or slightly drooping, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, mostly ascending, scabrous; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 19 to 24 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas white; first lemmas short to midlong (14 to 18 mm.), only slightly or no depressed dorsum, slightly glaucous, glabrous; basal hairs few or absent; awns common, occasionally dark-colored on lower parts, nontwisted to twisted and subgeniculate, 15 to 30 mm.; caryopses 6.5 to 8.0 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 6.0 mm. long; second floret rachilla segments usually slightly hairy, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 134.

FIGURE 134.—Spikelets and florets of Silvermine. (× 1.)

Silvermine, a spring oat, is distinguished from Belyak and Swedish Select in usually ripening a little earlier and in having more slender grains that usually are not depressed dorsally. Silvermine produces fewer and weaker awns, and the rachilla segments are usually slightly hairy.

History.—The origin of the stock of seed named Silvermine (C. I. 1013) has not been determined. The John A. Salzer Seed Co., La Crosse, Wis. (*138, 1896, p. 111*), introduced this variety to the trade in 1895 "as the heaviest yielding oat in the world," under the name of "Nameless White Beauty" (*138, 1895*). In that year prizes were offered by this company for the best name submitted. The result was that the name "Silvermine" was chosen in 1896 as the most appropriate, because of its prolificacy and silvery appearance, for which the company gave $300 in gold. According to a varietal survey in 1919 about 6 million acres of Silvermine were grown in that year.

Distribution.—Grown to a limited extent.

Synonyms.—Alexander, American Banner, Banner, Big Four, College Success, College Wonder, Czar of Russia, Granary Filler, Great American, Minnesota No. 281, Minnesota No. 368, Nameless White Beauty, Schoenen, Stiff-straw, 20th Century, Welcome, White Alaska.

Alexander (C. I. 1302) (*147*) is a pure-line selection from the old variety known as American Banner and was made by J. A. Jeffery, of the Michigan Agricultural Experiment Station, East Lansing, in 1900 (*148*). This variety is little grown today in Michigan.

American Banner (C. I. 197) is an old strain of the Silvermine type that has been grown for many years in the United States. It is very probable that James Vick's Sons, of Rochester, N. Y., (*203*), was the first to introduce this oat under the name "American Banner" in 1896. It was claimed not to be an old variety renamed but that it was developed from an original seed stock of about 1 pint. It was introduced as a variety of remarkable yield and general excellence. American Banner is now nearly obsolete.

Banner (C. I. 1402) apparently is identical with American Banner and probably originated simply by dropping the prefix "American". The Banner strains have been of much economic importance in Canada and of some importance in Oregon and Washington.

Big Four (C. I. 1641) was introduced in 1899 by the John A. Salzer Seed Co., of La Crosse, Wis. (*138, 1899, pp. 91–92*). The origin of the stock of seed named "Big Four" by Salzer has not been determined. Several of the commercial strains collected bearing the name "Big Four" are of the Swedish Select type, although a greater number are of the

Silvermine type. Big Four is now nearly obsolete.

College Success (C. I. 1588), a strain of the Silvermine type, was developed by the Michigan Agricultural Experiment Station East Lansing, under the direction of the late F. A. Spragg (*147*). This strain formerly was favored by the farmers of Ottawa and surrounding counties of Michigan, but it has been completely replaced by disease-resistant varieties.

College Wonder (C. I. 1589) (*147*) is a mate of Alexander, having been selected also by J. A. Jeffery (*148*). Similarly it has been replaced by disease-resistant varieties.

Czar of Russia (C. I. 1730) appears to have been obtained by Harry N. Hammond Seed Co., Ltd. (*68, p. 30*), from the Russian exhibit at the World's Fair in Chicago in 1893, for which Mr. Hammond paid $150 for a quart of seed. As this seed was the property of the late Czar of Russia, this name was applied to it. Mr. Hammond claimed it originated in western Siberia and was considered the most promising oat novelty in Russia. It is now nearly obsolete as a commercial variety.

Granary Filler, an unaccessioned oat, is just another name of unknown origin applied to a strain of the Silvermine type. It has been reported a few times in the United States. It has been distributed to some extent in eastern Canada where its adaptation has not been fully determined.

The Great American (C. I. 1554) strain was originated by commercial seed growers at Bloomington, Ill., about 40 years ago. Particulars are not available regarding its selection. Silvermine was never extensively grown under this name.

Minnesota No. 281 (C. I. 1297) and Minnesota No. 368, unaccessioned, are pedigreed strains of Silvermine, developed and distributed by the Minnesota Agricultural Experiment Station, St. Paul. These selections are now almost obsolete.

Schoenen (C. I. 1287) is an old oat, and the following record is contained in an Annual Report of the United States Department of Agriculture for 1869 (*198, p. 254*).

> The White Schönen, or Beautiful, oats were purchased by the Department in Hamburg, Germany, and distributed in the spring of 1868. This variety is native of Sweden.

It is probable that Schoenen is the progenitor of most of our numerous and differently named strains of the Silvermine variety. The original Schoenen appears to have almost entirely disappeared from cultivation in this country, but is of botanical interest.

The origin of Stiffstraw, unaccessioned, has not been determined. It was first reported from Pennsylvania in 1944 as being similar to Worthy oats.

The 20th (Twentieth) Century (C. I. 1637) strain was introduced to the seed trade in 1903 by the John A. Salzer Seed Co., of La Crosse, Wis. (*138, 1902, p. 83*). It is now little grown.

Welcome (C. I. 1634) (*20, 1884, p. 68*), introduced in the spring of 1884 by the W. Atlee Burpee & Co., of Philadelphia, Pa., was advertised as a new, improved variety of special merit, but no reference is made regarding the origin of the seed as obtained by Burpee. Welcome was grown rather extensively throughout the more northern oat section after its introduction, but it is now almost obsolete.

White Alaska (C. I. 1735), called Alaska in Canada, is of unknown origin and according to Derick (*47, 49, 50*) was introduced into Canada from the United States in 1900. White Alaska under some conditions matures a little earlier than Silvermine. It is rated as an early to midseason variety of considerable importance in Canada. White Alaska is distinct from the Alaska described in this bulletin.

Cartier

Description.—Cartier, a spring oat, differs from Silvermine in ripening a little earlier and in having a slightly smaller and shorter straw.

History.—Cartier (C. I. 2565, C. A. N. 133), according to Lods, the breeder (*102*), and Derick (*49, 50*), was developed at Macdonald College, Quebec, from a cross between Alaska and Early Triumph, made in 1913. It was accepted for registration in Canada in 1931 and distributed to farmers of Quebec in 1932.

Distribution.—Grown to a limited extent in Indiana. Also grown to some extent in the Province of Quebec, Canada.

Comewell

Description.—Comewell, a spring oat differs from Silvermine in being more uniform in plant and grain characters, in growing a little taller, and usually in having fewer awns.

History.—Comewell (C. I. 1317) (*103*) originated as a pure-line selection from Welcome, made by the late J. B. Norton, then of the United States Department of Agriculture, about 1904 at Shirley, Ill. It was subsequently developed by the Department of Plant Breeding, Cornell University, Ithaca, N. Y., and first distributed to farmers of

New York as an unnamed selection in 1912. Owing to continued excellent performance on farms, the selection was named "Comewell" by H. H. Love during Farmer's Week at Cornell University, February 1921. Comewell is registered as an improved variety (*170*). It was developed by the Cornell University Agricultural Experiment Station in cooperation with the United States Department of Agriculture. It was grown extensively in Dutchess County and adjoining counties in New York, but it has been replaced by disease-resistant varieties.

Distribution.—Grown to a very limited extent.

Empire

Description.—Empire, a spring oat, differs from Silvermine in being more uniform in plant and grains characters and in having a little shorter straw and usually more awns.

History.—Empire (C. I. 1974) (*103*) originated as a pure-line selection from Big Four, made by members of the Department of Plant Breeding, Cornell University, Ithaca, N. Y., in 1912. It was first distributed to farmers in 1918. Empire is registered as an improved variety (*170*). It was developed by the Cornell University Agricultural Experiment Station in cooperation with the United States Department of Agriculture.

Distribution.—Grown to a very limited extent.

Erban

Description.—Erban, a spring oat, differs from Silvermine in ripening a little earlier, in having slightly plumper grains, and in being moderately resistant to certain races of crown rust found in Canada and the Northeastern States. Moderate resistance to the oat smuts also is claimed for the variety.

History.—Erban (C. I. 3838) (*49, p. 10, 50*) was developed by the Ontario Agricultural College at Guelph, Canada, from a cross between Banner and Early Ripe (a strain of Burt). It was first distributed to farmers in 1935 and accepted for registration in Canada in 1937. It was grown to some extent in the New England States, New York, and eastern Canada, but it has been replaced by varieties with more complete disease resistance.

Distribution.—Grown to a very limited extent.

Forward

Description.—Forward, a spring oat, differs from Silvermine in being more uniform in plant and grain characters, in growing a little taller, and usually having fewer awns.

History.—Forward (C. I. 2242, Wis. No. 1241) (*98*) originated as a pure-line selection from Silvermine, made at the Ashland Branch Experiment Station, Ashland, Wis., by the late E. J. Delwiche in 1911. Forward was distributed to farmers in 1919 from seed produced at Ashland. It is registered as an improved variety (*170*). Forward was grown on more than 15 percent of the oat acreage of Wisconsin in 1935 (*156, p. 387*).

Distribution.—Grown to a very limited extent.

Idamine

Description.—Idamine, a spring oat, differs from Silvermine in having whiter lemmas, slightly plumper grains, and usually fewer awns.

History.—Idamine (C. I. 1834) was developed at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, as a pure-line selection from a midseason white oat known as Funk by the United States Department of Agriculture, in cooperation with the Idaho Agricultural Experiment Station. The original selection was made in 1915 by the late C. W. Warburton and L. C. Aicher. Idamine is registered as an improved variety (*170*) and was first distributed to southern Idaho farmers in 1921. It was grown on 15 percent of the oat acreage of southern Idaho in 1935 (*156, p. 381*).

Distribution.—Grown to a very limited extent.

Synonym.—Funk.

Ithacan

Description.—Ithacan, a spring oat, differs from Silvermine in being more uniform in plant and grain characters and in usually having fewer awns.

History.—Ithacan (C. I. 2141) (*103, p. 6*) originated as a pure-line selection from National, a commercial variety, in 1914 by the Department of Plant Breeding, Cornell University, Ithaca, N. Y., in cooperation with the United States Department of Agriculture. Ithacan is registered as an improved variety (*170*). It was first distributed to farmers in 1922. It was grown on about 10 percent of the oat acreage of New York in 1935 (*156, p. 383*).

Distribution.—Grown to a very limited extent.

Lenroc

Description.—Lenroc, a spring oat, differs from Silvermine in having slightly smaller culms, little shorter lemmas, and more slender grains. It also has more awns than is usually found in the more typical strains of Silvermine.

History.—Lenroc (C. I. 3205) originated as a selection from a cross be-

tween Great American (Silvermine type) and Cornellian made in 1918 by the late W. T. Craig at Ithaca, N. Y., of Cornell University, in cooperation with the United States Department of Agriculture. It was distributed to farmers in 1935 and is registered as an improved variety (*154, v. 27*).

Distribution.—Grown to a very limited extent.

Marida

Description.—Marida, a spring oat, differs from Silvermine in usually ripening a few days earlier and in having a little shorter and stiffer straw, slightly shorter grain, fewer awns, and resistance to most races of the oat smuts. This smut reaction definitely separates Marida from Silvermine.

History.—Marida (C. I. 2571) originated from a cross between Markton and Idamine oats made by G. A. Wiebe at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1923, in cooperation with the Idaho Station and the United States Department of Agriculture. Many selections from this cross were tested for resistance to smut at Aberdeen from 1924 to 1928. Seed of certain selections was sent to the Idaho Agricultural Experiment Station, Moscow, in 1929 for testing. Selection C. I. 2571 proved to be the most promising in yield and quality. It was named "Marida," and distributed in 1940 to farmers on the nonirrigated lands of northern Idaho. It is registered as an improved variety (*154, v. 34*).

Distribution.—Grown in Idaho, Montana, North Dakota, Oregon, and Washington.

Mission

Description.—Mission, a spring oat, differs from Silvermine in ripening a little later and in having slightly longer lemmas and usually fewer awns. Mission resists the races of the oat smuts that occur in Montana, which definitely distinguishes it from the major type.

History.—Mission (C. I. 2588) originated from the same cross between Markton and Victory from which Bannock, Bridger, and Huron varieties, described in this bulletin, were developed. In 1929 a group of selections resistant to the oat smuts were sent from Aberdeen, Idaho, to the Montana Agricultural Experiment Station at Bozeman, for testing. In tests conducted from 1929 to 1944 by S. C. Litzenberger and Royse P. Murphy, one of these selections, C. I. 2588, proved to be outstanding in performance, especially on dry land. It was named "Mission," and distributed to farmers as a registered improved variety in 1945 (*153, v. 37*). Mission thus was developed by the Montana and Idaho Agricultural Experiment Stations in cooperation with the United States Department of Agriculture.

Distribution.—Grown in Idaho, Oregon, Montana, and Washington.

Rusota

Description.—Rusota, a spring oat, differs from Silvermine in having a little shorter and smaller straw, smaller panicles, slightly shorter lemmas, and more slender grains. Rusota is moderately resistant to certain races of stem rust, which reaction distinguishes it from Silvermine.

History.—Rusota (C. I. 2343, N. Dak. No. 20014) originated as a pure-line white oat selection from Green Russian made by T. E. Stoa in 1922 at Fargo, N. Dak. It was subsequently developed by the North Dakota Agricultural Experiment Station, Fargo, and was first distributed to farmers of northeastern North Dakota in 1935. Rusota is registered as an improved variety (*154, v. 27*).

Distribution.—Grown to a very limited extent in northeastern North Dakota and northwestern Minnesota.

Spooner

Description.—Spooner, a spring oat, differs from Silvermine in being more uniform in plant and grain characters, in growing a little taller, and in usually having fewer awns.

History.—Spooner (C. I. 3165, Wis. No. S–107) originated at the Spooner Substation of the Wisconsin Agricultural Experiment Station as a pure-line selection from Wisconsin No. 8 (Silvermine type). The selection was made by the late E. J. Delwiche in 1913, and was subsequently named in honor of the late United States Senator John C. Spooner of Wisconsin. Spooner is registered as an improved variety (*154, v. 27*). It was first distributed to farmers in 1919, and was grown on over 7 percent of the oat acreage of Wisconsin in 1935 (*156, p. 287*).

Distribution.—Grown to a very limited extent.

Standwell

Description.—Standwell, a spring oat, differs from Silvermine in ripening a few days earlier, in having a little shorter straw and usually fewer awns, and in being more uniform in plant and grain characters.

History.—Standwell (C. I. 1975) (*103, p. 6*) originated as a pure-line selection from Lincoln, made in 1912 at Ithaca, N. Y. It was developed by the Department of Plant Breeding at Cornell University, in cooperation with the United States Department of Agriculture. Standwell

is a registered variety (*170*) and was first distributed to farmers in 1918.

Distribution.—Grown in New York to a very limited extent.

Vanguard

Description.—Vanguard, a spring oat, differs from Silvermine in maturing 2 to 4 days later, growing a little taller, and in having a stiffer straw and slightly plumper grains. It is resistant to halo blight and many races of stem rust, but susceptible to crown rust and the oat smuts. The resistance to stem rust aids in distinguishing Vanguard from the major type, Silvermine.

History.—Vanguard (C. I. 3837, C. A. N. 651) (*207*) originated from a cross between Hajira and Banner made in 1936 at the Dominion Laboratory of Cereal Breeding, Winnipeg, Canada. It was first distributed to farmers chiefly in the prairie Provinces of western Canada in 1926. Vanguard was accepted for registration in Canada in 1937.

Distribution.—Grown to a limited extent in the United States and in Canada.

Wisconsin Wonder

Description.—Wisconsin Wonder, a spring oat, differs from Silvermine in having a little shorter straw, slightly more slender grain, and usually more basal hairs.

History.—Wisconsin Wonder (C. I. 1645) (*98, p. 9*) originated as a pure-line selection made at Madison, Wis., in 1903 from a mass variety received from a Jefferson County, Wis., farmer in 1901. It was bred by the centgener method, and among many individual selections Pedigree No. 1 was selected. It has not been possible to determine the source of the original seed first sown by the Jefferson County farmer. It is registered as an improved variety (*170*). Wisconsin Wonder was grown on 10 percent of the oat acreage of Wisconsin 1935 (*156, p. 387*).

Distribution.—Grown to a very limited extent.

Wolverine

Description.—Wolverine, a spring oat, differs from Silvermine in being more uniform in plant and grain characters and in having a slightly larger and stiffer straw and usually fewer awns.

History.—Wolverine (C. I. 1591) originated at the Michigan Agricultural Experiment Station, East Lansing, as a pure-line selection from an unnamed commercial variety. It was isolated in 1911 by the late F. A. Spragg (*44, 147*). Wolverine is a registered variety and was first distributed to farmers of Michigan in 1917 (*171*). It was grown on about 75 percent of the oat acreage of Michigan in 1935 (*156, p. 383*).

Distribution.—Grown to a limited extent.

Worthy

Description.—Worthy, a spring oat, is almost the exact counterpart of Wolverine in all plant and grain characters, except under some conditions it grows a little taller.

History.—Worthy (C. I. 1590), a close relative of Wolverine, was selected in 1906 by the late F. A. Spragg of the Michigan Agricultural Experiment Station, East Lansing (*44, 147*). It is an improved registered variety (*171*) and was first distributed to farmers in 1911 (*147, p. 122*). It was grown on about 7 percent of the oat acreage of Michigan in 1935 (*156, p. 383*).

Distribution.—Grown to a very limited extent.

Anthony

Description.—Juvenile growth erect; plants midseason to late, slightly glaucous at time of full heading, tall (120 to 150 cm.); culms midsized, fairly stiff, usually glabrous at the nodes; sheaths dark-green, glaucous, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, drooping, fairly stiff, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, spreading or slightly drooping, scabrous; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 19 to 24 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas white, first lemmas, midlong to long (16 to 20 mm.), none or slightly depressed dorsum, slightly glaucous, glabrous; basal hairs few or absent; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 6.0 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 135.

Anthony, a spring oat, differs mainly from Belyak in being decidedly less glaucous and a little later in maturity, in growing somewhat taller, and usually in having less erect panicles. It also has midlong to long lemmas and more slender grains. Anthony is resistant to some races of stem rust but is highly susceptible to most races of the oat smuts.

FIGURE 135.—Spikelets and florets of Anthony. (× 1¼.)

History.—Anthony (C. I. 2143, Minn. No. 686) originated as a selection from a cross between White Tartar (White Russian) and Victory made at University Farm, St. Paul, Minn., by the Minnesota Agricultural Experiment Station. The original cross, from which the selection named "Anthony" was obtained, was made at University Farm, St. Paul, in 1918. Subsequent selections were made for resistance to stem rust and for desirable agronomic characters. The particular selection named "Anthony" was derived by bulking individual plant rows studied for five generations. It was first distributed to farmers in 1929 and registered as an improved variety (*169*). Anthony was grown on 15 percent of the oat acreage in Minnesota in 1935 (*156, p. 383*).

Distribution.—Grown to a very limited extent.

Minrus

Description.—Minrus, a spring oat, differs from Anthony in having slightly larger panicles and little longer lemmas. It is a slightly variable variety in certain plant and grain characters. It has resistance to many races of stem rust but is susceptible to crown rust and smut.

History.—Minrus (C. I. 2144, Minnesota No. 687) (*156, p. 383*) was developed from a cross between Minota and White Tartar (White Russian) made by H. K. Hayes and R. J. Garber in 1918, at the Minnesota Agricultural Experiment Station, St. Paul. It was first distributed to farmers in 1931. Minrus was grown on 15 percent of the oat acreage of Minnesota in 1935.

Distribution.—Grown to a very limited extent.

Victory

Description.—Juvenile growth erect; plants midseason to late, usually slightly glaucous, midtall to tall (90 to 140 cm.); culms midsized to large, stiff, usually glabrous at the nodes; sheaths dark-green, glaucous, glabrous; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles equilateral, usually erect, stiff, midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, mostly ascending, scabrous; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 19 to 24 mm. long, 6 to 8 mm. wide, 9- to 10-veined, light-green and slightly glaucous before maturity; grains midplump to plump; lemmas white; first lemmas short to midlong (14 to 17 mm.), none or slightly depressed dorsum, rather glaucous, glabrous; basal hairs few or absent; awns few to common, nontwisted to twisted and subgeniculate (15 to 25 mm.); caryopses 6.5 to 8.0 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 5.5 to 6.0 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets of Victory are shown in figure 136.

FIGURE 136.—Spikelets and florets of Victory. (× 1⅛.)

Victory, a spring oat, differs from Belyak in having more erect panicles and less glaucous grains. Under some conditions Victory also produces more 3-flowered spikelets. It is a few days later in maturity than Belyak or Swedish Select and about a week later than Silvermine.

History.—Victory (C. I. 560, Seger, Svalöf No. 0355) originated in 1892 at the Swedish Plant Breeding Station, Svalöf, Sweden (*116, pp. 122–128; 156, p. 40*). It was developed from a single plant selected by Hjalmar Nilson out of the old Milton oat, an unselected variety that had been introduced into Sweden from the Baltic region of Europe. Victory was first introduced to farmers of Sweden in 1908. It was first introduced into the

United States on March 12, 1908, by D. G. Fairchild, of the United States Department of Agriculture (P. I. 22306) (*197*). Numerous lots of experimental seed of Victory have been received from Sweden by State agricultural experiment stations and many thousand bushels by seed importing companies since 1908. Victory has been recorded as one of the most important varieties ever developed in any country (*156*), but in the United States it is being replaced by disease-resistant varieties.

Distribution.—Grown to some extent in the more Northern States.

Synonyms.—Belgium, Hvitling, Seger, Svalöf Victory, Svalöf's Hvitling Hafre, Swedish Victory.

"Belgium" (C. I. 3614) is a name under which Victory has been exploited as a great new variety; however, very little Victory is grown under this name at present. "Hvitling" (C. I. 1062), "Seger" (C. I. 2020), "Svalöf Victory" (C. I. 1576), and "Swedish Victory" (C. I. 1840) are simply other names that have been applied and used for imported lots of seed of the Victory variety. Hvitling was applied to a strain of oats identical with Victory by the Plant Breeding Station at Svalöf, Sweden. D. A. Fairchild of the United States Department of Agriculture on March 22, 1907, introduced Svalöf's Hvitling Hafre (white oats) (P. I. 20458) (*197*) from Svalöf, Sweden, and it was distributed to a number of experiment stations.

Bannock

Description.—Bannock, a spring variety, differs from Victory in ripening a few days earlier and in having little shorter straw, little longer lemmas, and usually more awns. It is highly resistant to most races of the oat smuts, which separates Bannock from Victory.

History.—Bannock (C. I. 2592) originated from a cross between Markton and Victory made by G. A. Wiebe of the United States Department of Agriculture, at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, in 1923. Numerous selections were made from this cross and tested for smut resistance and desirable agronomic characters in successive generations at the Branch Station and also at other agricultural experiment stations in the Rocky Mountain and Pacific Northwestern States. One of these selections proved to be outstanding for resistance to smut and yield and was named Bannock in 1938. It is registered as an improved variety (*154, v. 30*) and is the product of cooperative breeding between the Idaho Agricultural Experiment Station and the United States Department of Agriculture. Bannock was first distributed to farmers of southern Idaho in 1938.

Distribution.—Grown in Colorado, Idaho, Montana, Oregon, Utah, Washington, and Wyoming.

Bridger

Description.—Bridger, a spring oat, differs from Victory in having a slightly larger and stiffer straw, longer lemmas, and slightly plumper grains. It is resistant to most races of the oat smuts. Like Bannock, this resistance to smut distinguishes Bridger from Victory.

History.—Bridger (C. I. 2611) originated from the same cross between Markton and Victory oats that gave rise to Bannock. Some of the more promising selections from this cross that had been resistant to smut at the Aberdeen Branch Experiment Station, Aberdeen, Idaho, were sent to the Montana Agricultural Experiment Station at Bozeman, Mont., in 1929, where they were tested from 1929 to 1941. Selection C. I. 2611 proved to be outstanding for resistance to smut, for stiff straw, and for yielding ability. It was named "Bridger" and distributed in 1941 from the Montana station for growing under irrigation. Bridger thus was developed by the Montana and Idaho Agricultural Experiment Stations in cooperation with the United States Department of Agriculture. It is registered as an improved variety (*154, v. 35*).

Distribution.—Grown in Idaho, Montana, Oregon, and Washington.

Eagle

Description.—Eagle, a spring oat, differs from Victory in ripening a few days earlier, in having a little shorter and stiffer straw, slightly longer lemmas, and more slender grains.

History.—Eagle (C. I. 4113) originated at the Swedish Plant Breeding Station, Svalöf, Sweden, from a cross between Victory (Seger) and the German variety von Lochow's Gelbhafer, made by A. Akerman in 1914 (*156, p. 402*). It was first distributed to farmers of Sweden in 1931. Eagle has been introduced into the United States through various channels. An introduction of experimental seed (P. I. 134718) (*197*) was made by the United States Department of Agriculture in 1939.

Distribution.—Grown to a limited extent.

Exeter

Description.—Exeter, a spring oat, differs from Victory in ripening a day or two earlier and in having a little shorter

straw and slightly longer lemmas. It is resistant to the common races of stem rust, which distinguishes it from the susceptible Victory. It also has some resistance to halo blight.

History.—Exeter (C. I. 4158, R. L. 53, C. A. N. 661) (*208*) originated from a cross between Victory and Rusota, made in 1929, at the Dominion Laboratory of Cereal Breeding, Winnipeg, Canada. Stem-rust-resistant lines of this cross were bulked in the F_3 and given a yield test for 3 years. Selections were then made from the high-yielding families, and a number of them were placed in a rod-row test at Winnipeg in 1937. A few of the most promising lines were placed in the cooperative rod-row tests in 1938. Selection R. L. 53 proved to be one of the highest yielding lines included in these tests and was accepted for registration in Canada in 1941. Exeter was first distributed in small quantities to seed growers for sowing in the spring of 1942 and to farmers of Canada in the spring of 1944.

Distribution.—Grown to a very limited extent in several of the more northern States of the United States, and also to some extent in the western Provinces of Canada, especially in those sections in which late-maturing varieties are usually the most productive.

Huron

Description.—Huron, a spring oat, differs from Victory in ripening a few days earlier and in having slightly shorter straw, little longer lemmas, and usually more awns. It has high resistance to most races of the oat smuts that distinguishes Huron from Victory.

History.—Huron (C. I. 3656) (*53*) originated from the same cross between Markton and Victory from which both Bannock and Bridger were selected. Smut-resistant selections from this cross were sent to the Michigan Agricultural Experiment Station, East Lansing, by the United States Department of Agriculture in 1929. Plant reselections were made in 1932 to purify one of the strains accessioned as C. I. 2590. One of these reselections, No. 5210, appeared promising enough to warrant testing in several parts of Michigan; favorable results were obtained. This strain was increased in 1938 and 1939, named "Huron," and distributed to farmers of the Lower Peninsula in 1940. Huron was thus developed cooperatively by the Idaho and Michigan Agricultural Experiment Stations and the United States Department of Agriculture. It is a registered variety (*154, v. 33*).

Distribution.—Grown to a limited extent in Michigan and Ohio.

Star

Description.—Star, a spring oat, differs from Victory in ripening a little later and in having slightly more slender grains.

History.—Star (C. I. 2753, P. I. 77882 and 78587) (*197*) originated at the Swedish Plant Breeding Station, Svalöf, Sweden, from a cross between Victory and Crown made by L. Walstedt in 1908 (*156, p. 401*). It was distributed in 1927 for growing on farms in Sweden and first introduced into the United States from Sweden for experimental purposes in 1929.

Distribution.—Grown to a very limited extent.

Castleton

Description.—Juvenile growth semiprostrate to erect; plants very late, light-green at time of full heading, midtall to tall (90 to 140 cm.); culms midsized to large, weak, usually glabrous at the nodes; sheaths light-green, usually slightly hairy; culm leaves midwide to wide, margins ciliate; peduncles large, occasionally slightly bent, fully exserted; panicles equilateral, slightly drooping, midsized, midlong, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually very flexuous, nodes 5 to 7; branches long, ascending or drooping from the middle outward, scabrous; spikelets usually numerous, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 17 to 21 mm. long, 6 to 9 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains plump, some double; lemmas yellowish-white to white; first lemmas very short to short (12 to 15 mm.), depressed dorsum, glabrous; basal hairs few to several; awns numerous, dark-colored on the lower parts, twisted and geniculate, 20 to 30 mm. long; caryopses 7 to 9 mm. long; second lemmas 6 to 11 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 137.

Castleton, a spring oat, is similar to the Canadian parent in many morphological characters, except it is semiprostrate to erect in early growth and very much later in maturity, and has numerous, twisted and geniculate awns that are usually dark-colored on the lower parts. Castleton also has more basal hairs and the panicles are not so large as those of Canadian. The very late maturity definitely distinguishes Castleton from Canadian.

History.—Castleton (C. I. 2302) was brought to the United States from Scotland, where it apparently resulted from a

FIGURE 137.—Spikelets and florets of Castleton. (× 1⅛.)

cross between the Canadian (Potato) and some late-maturing variety with a prostrate habit of early growth. Castleton is described by Marquand (*107, p. 17*) as being synonymous with a variety known as Scotch Potato and in being similar to Canadian.

Distribution.—Grown to a very limited extent.

Synonyms.—Castleton Potato (C. I. 1072), Scotch Potato.

Sandy

Description.—Juvenile growth semiprostrate to erect; plants very late, dark-green at time of full heading, midtall to tall (110 to 140 cm.); culms small, rather weak, glabrous at the nodes; sheaths dark-green, usually glabrous; culm leaves narrow to midwide, margins glabrous; peduncles small to midsized, straight, usually fully exserted; panicles equilateral, drooping, midsized, midlong to long, midbroad, ovate, lower whorl of panicle branches arising at normal rachis nodes; rachises usually flexuous, nodes 6 to 9; branches midlong, ascending or spreading, scabrous; spikelets numerous, 1- to 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 25 mm. long, 5.5 to 7.5 mm. wide, 9- to 10-veined, light-green at time of full heading and of reddish to creamy-white color at maturity; grains slender, many single; lemmas reddish-yellow to white (creamy-white); first lemmas very short to short (12 to 15 mm.), no depressed dorsum, glabrous; basal hairs few or absent; awns few or absent; caryopses 6 to 8 mm. long; second lemmas 8 to 10 mm. long; awns absent; caryopses 4 to 6 mm. long; second floret rachilla segments hairy, long (2.5 to 3.5 mm.). Spikelets and florets of Sandy are shown in figure 138.

Sandy is a distinct variety of spring oats, although semiprostrate to erect in early growth. It usually can be rec-

FIGURE 138.—Spikelets and florets of Sandy. (× 1¼.)

ognized by the reddish-yellow to white (creamy-white) color of the plants and grains at maturity and also by its straw and very late maturity. The lemmas are very short to short and the grains slender, with many single. The number of rachis nodes is greater than in any other variety. Sandy is of taxonomic interest.

History.—Sandy (C. I. 2783) is an old variety that has been grown in Scotland for many decades, but there is no definite information on its origin. Marquand (*107, p. 18*) described Sandy but does not give its origin.

Distribution.—None.

Synonym.—Sandwich.

Sandwich (C. I. 1194) is a commercial English strain that probably originated as a selection from Sandy. It is grown experimentally in the United States.

Garton No. 473

Description.—Juvenile growth erect; plants late, short to midtall (60 to 110 cm.); culms very large, stiff, usually glabrous at the nodes; sheaths light-green, glabrous or slightly hairy; culm leaves wide, margins ciliate; peduncles large, bent, occasionally not fully exserted; panicles equilateral to semiequilateral, erect, small to midsized, short to midlong, midbroad, ovate, lower whorl of panicle branches arising at normal or secondary rachis nodes; rachises slightly flexuous, nodes 4 to 7; branches short to midlong, ascending, confused in attitude, somewhat scabrous; spikelets usually few, 2-flowered, separating by fracture; florets separating by disarticulation; glumes 24 to 28 mm. long, 7 to 10 mm. wide, 9- to 11-veined, light-green and somewhat glaucous before maturity; grains very plump, many double; lemmas yellowish-white to white; first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs few or absent; awns few to common, twisted and subgeniculate, 15 to 30 mm. long; caryopses 8 to 10 mm. long; second lemmas 10 to 14 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous or

sparsely hairy, midlong (1.5 to 2.0 mm.). Spikelets and florets of Garton No. 473 are shown in figure 139.

FIGURE 139.—Spikelets and florets of Garton No. 473. (× ¾.)

Garton No. 473, a spring oat, is distinct in having very large culms, small to midsized, equilateral to semiequilateral panicles, usually with normal lower nodes. It also matures rather late, the lemmas are midlong to long, and the grains plump with thick hulls. Double grains (bosom) are also common.

History.—Garton No. 473 (C. I. 1883) (*61*) was developed by Garton's Ltd., Warrington, England, from a cross between Storm King and an unknown variety with equilateral panicles.

Distribution.—Grown to a very limited extent.

Garton No. 5

Description.—Similar to Garton No. 473 except for the following characters: Plants midtall to tall (90 to 140 cm.); panicles equilateral, mostly drooping, midsized to large, long, broad; rachises usually very flexuous; branches midlong to long, usually spreading or ascending, not confused in attitude; awns few or absent. Spikelets and florets of Garton No. 5 are shown in figure 140.

FIGURE 140.—Spikelets and florets of Garton No. 5. (× 7/10.)

Garton No. 5, a spring oat, differs primarily from Garton No. 473 in having larger panicles with very flexuous rachises. Under most conditions, Garton No. 5 also has decidedly taller culms and fewer awns. A number of the so-called Garton 5 strains have little varietal significance, as many of them are not homozygous. These large, thick-hulled, late-maturing oats are poorly adapted to the United States.

History.—Garton No. 5 (C. I. 1311) was developed by Garton's Ltd., Warrington, England, from a cross between Storm King and an unknown variety with branching panicles.

Distribution.—Grown to a very limited extent.

Synonyms.—Australian, Garton No. 691, Giant Australian, Kiama, New Leader, Plaza, Royal Scot, Sweet Clover Oats, Swenson, (20th) Twentieth Century, Wonder.

Garton No. 5 was described under the name "Garton No. 691" (C. I. 1884) by Etheridge (*61, p 141*). New Leader (C. I. No. 1942), also a production of Garton's Ltd., Warrington, England, is a strain of Garton No. 5, formerly grown to some extent in Canada. Royal Scot (C. I. 3836), a production of the Garton No. 5 type by Garton's Ltd., was introduced into the United States in the late 1930's. It originated from a cross between Victory and Record, and according to Garton's Ltd., it was in process of development for 19 years. Royal Scot has been of no special promise in the United States. Swenson is a strain of Garton No. 5 that was originated on the farm of Enoch Swenson, North Branch, Chisago County, Minn., in 1922, from a stray plant found in a field of oats some years previous. Owing to its large straw, thick hull, and low yield, the Swenson oat has become almost obsolete. Garton No. 5 also was known as Australian, Giant Australian, Kiama, Plaza, Sweet Clover Oats, Twentieth Century, and Wonder. Stoa (*180, pp. 18–19*) discussed the exploitation of this oat in North Dakota.

(COMMON) SIDE OAT

The side oat (*Avena sativa* L. ssp. *orientalis* Schreb.) is of much less economic importance than the tree oat in the United States. Owing to its somewhat lower yielding power, the side oat is now grown decidedly less extensively. The special characters occurring only in the side oat, which have been found useful for identification and classification, have been fully discussed under morphological characters. There are no varieties of winter oats with side panicles.

Etheridge (*61, pp. 154–163*) recognized 11 and Marquand (*107, pp.*

27–34) 22 distinct varieties of the side oat. In this bulletin 18 varieties are recognized.

Several of the newer oats with side or semiside panicles, especially those developed and introduced by Garton's Ltd., Warrington, England, recognized as varieties by Marquand, have not been found to be homozygous in the United States and, therefore, have not been considered as distinct varieties.

A key to the varieties of the side oat follows:

KEY TO THE VARIETIES OF (COMMON) SIDE OATS

		Page
1a. *Lemmas black.*		
2a. Ligules absent.		
3a. Lower whorl of panicle branches arising at normal rachis nodes.		
Plants midseason to late.		
Plants short to midtall (70 to 110 cm.).		
Lemmas brownish-black to black.		
Panicles short to midlong, narrow to midbroad.		
First lemmas short to midlong (14 to 17 mm.), slightly glaucous.		
First lemmas awns common.		
Grains midplump to plump	GARTON No. 748	182
Panicles midlong, midbroad.		
First lemmas midlong to long (17 to 20 mm.), very glaucous.		
First lemmas awns few or absent.		
Grains plump	GARTON No. 784	183
Plants very late.		
Plants midtall to tall (90 to 130 cm.).		
Lemmas black.		
Panicles very long, narrow.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns few or absent.		
Grains slender to midplump	ORIENTAL	183
2b. Ligules present.		
3a. Lower whorl of panicle branches arising at secondary or normal rachis nodes.		
Plants midseason to late.		
Lemmas brownish-black to black.		
Panicles midlong, midbroad.		
First lemmas awns few to common.		
First lemmas short to midlong (14 to 17 mm.).		
Plants short to midtall (60 to 120 cm.).		
Grains plump, many double	BLACK RIVAL	184
First lemmas midlong to long (16 to 19 mm.).		
Plants midtall to tall (90 to 130 cm.).		
Grains slender to midplump, some double.	BLACK TARTAR	184
	SIR DOUGLAS HAIG	185
1b. *Lemmas gray.*		
2a. Ligules present.		
3a. Lower whorl of panicle branches usually arising at normal rachis nodes.		
Plants late.		
Plants midtall to tall (90 to 140 cm.).		
Lemmas dark-gray (mottled).		
Panicles unilateral to semiunilateral, midlong, midbroad.		
Branches somewhat confused in attitude.		
First lemmas midlong to long (16 to 20 mm.).		
First lemmas awns common to numerous.		
Grains midplump to plump	GARTON GRAY	185

KEY TO THE VARITIES OF (COMMON) SIDE OATS—Continued

		Page
1b. *Lemmas gray*—Continued		
Lemmas light-gray.		
Panicles unilateral, long, narrow.		
Branches pectinate in attitude.		
First lemmas long to very long (19 to 22 mm.).		
First lemmas awns few or absent.		
Grains slender	SEIZURE	176
1c. *Lemmas yellow.*		
2a. Ligules absent.		
3a. Lower whorl of panicle branches arising at normal rachis nodes.		
Lemmas yellow.		
Plants midseason to late.		
Plants short to midtall (60 to 100 cm.).		
Panicles, small, short.		
First lemmas short to midlong (14 to 17 mm.).		
First lemmas awns few or absent.		
Grains midplump	GARTON YELLOW	186
Plants late.		
Plants midtall to tall (90 to 130 cm.).		
Panicles midsized, midlong to long.		
First lemmas midlong to long (17 to 20 mm.).		
First lemmas awns common.		
Grains slender to midplump	GOLDEN GIANT	187
2b. Ligules present.		
3a. Lower whorl of panicle branches arising at normal rachis nodes.		
Lemmas reddish-yellow (creamy-white).		
Plants early to midseason.		
Plants short to midtall (70 to 110 cm.).		
Panicles midsized, very long.		
First lemmas midlong to long (17 to 20 cm.).		
First lemmas awns few or absent.		
Grains slender	DON DE DIEU	188
1d. *Lemmas white.*		
2a. Ligules present.		
3a. Lower whorl of panicle branches arising at normal or secondary rachis nodes.		
Plants midseason.		
Lemmas yellowish-white to white.		
Panicles large, midbroad.		
First lemmas short to midlong (15 to 18 mm.), no depressed dorsum.		
First lemmas awns few to common.		
Plants short (60 to 90 cm.).		
Grains very plump, many double	STORM KING	188
First lemmas midlong to long (16 to 19 mm.), no depressed dorsum.		
First lemmas awns few or absent.		
Plants short to midtall (80 to 110 cm.).		
Grains midplump to plump, few double.	TARTAR KING	189
Plants late.		
Lemmas yellowish-white (pale-yellow).		
Panicles midsized, narrow.		
First lemmas very short (12 to 14 mm.), depressed dorsum.		
First lemmas awns few or absent (rare).		
Plants midtall to tall (90 to 130 cm.).		
Grains plump, few or none double	SPARROWHILL	190

KEY TO THE VARITIES OF (COMMON) SIDE OATS—Continued

		Page
1d. *Lemmas white*—Continued		
3b. Lower whorl of panicle branches arising at normal rachis nodes.		
Panicles unilateral.		
Branches pectinate in attitude.		
Plants midseason to late.		
Plants midtall to tall (90 to 130 cm.).		
Culms midsized.		
Grains slender.		
Lemmas yellowish-white to white.		
First lemmas very short to short (12 to 15 mm.).	SCHUMACHER No. 7.	190
Lemmas white.		
First lemmas midlong (16 to 18 mm.).		
First lemmas awns few or absent.	WHITE TARTAR	191
First lemmas awns common, nontwisted to twisted and subgeniculate.	GREEN MOUNTAIN	192
Panicles unilateral to semiunilateral.		
Branches confused in attitude.		
Plants late.		
Plants midtall to tall (80 to 130 cm.).		
Culms large.		
Grains midplump to plump.		
Lemmas white.		
First lemmas long to very long (19 to 23 mm.).		
First lemmas awns common, nontwisted to twisted and subgeniculate.	MARVELOUS	192

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONOMY OF VARIETIES OF (COMMON) SIDE OAT

Garton No. 748

Description.—Juvenile growth erect; plants midseason to late, short to midtall (70 to 110 cm.), only slightly glaucous; culms midsized, very stiff, glabrous at the nodes; sheaths dark-green, glabrous, somewhat glaucous, ligules absent; culm leaves midwide, margins glabrous; peduncles midsized to large, straight, occasionally not fully exserted; panicles unilateral, erect, midsized, short to midlong, narrow to midbroad, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong ascending, somewhat pectinate in attitude, scabrous; spikelets usually few, 2-flowered, occasionally 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5.0 to 7.5 mm. wide, 8- to 9-veined, light-green and glaucous before maturity; grains midplump to plump; lemmas brownish-black to black; first lemmas short to midlong (14 to 17 mm.), usually slightly glaucous, glabrous; basal hairs few or absent; awns common, nontwisted to twisted and geniculate, 20 to 30 mm. long; caryopses 6.5 to 8.5 mm. long; second lemmas 8 to 12 mm. long; awns absent; caryopses 4.5 to 6.5 mm. long; second floret rachilla segments hairy, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 141.

Garton No. 748, a liguleless spring oat, differs from Oriental in having shorter

FIGURE 141.—Spikelets and florets of Garton No. 748. (× 1⅛.)

culms, shorter, stiffer, and usually more erect panicles, slightly more glaucous lemmas, and more awns. It also is a little earlier in maturity and is mainly of taxonomic interest.

History.—Garton No. 748 (C. I. 1862) was originated by Garton's Ltd., Warrington, England. It apparently was first introduced into the United States by a commercial seed company of Chicago, Ill., about 1907, from whom it was obtained by the United States Department of Agriculture in April 1908 and accessioned C. I. 566. Since that time the variety also has been received from a few State experiment stations. The strain used in these studies represented a mass selection from the original introduction.

Distribution.—None.

Garton No. 784

Description.—Similar to Garton No. 748 except for the following characters: Plants very glaucous; panicles midlong, midbroad, branches somewhat confused in attitude; grains plump; first lemmas midlong to long (17 to 20 mm.), very glaucous; awns few or absent; second floret rachilla segments glabrous or sparsely hairy, short to midlong (1.5 to 2.0 mm.). Spikelets and florets of Garton No. 784 are shown in figure 142.

FIGURE 142.—Spikelets and florets of Garton No. 784. (× 1⅛.)

Garton No. 784, a liguleless spring oat, differs from Garton No. 748 in having broader panicles with the branches more confused in attitude, plumper grains, longer and more glaucous lemmas, few or no awns, and slightly shorter second floret rachilla segments. Garton No. 784 is mainly of taxonomic interest.

History.—Garton No. 784 (C. I. 1863) was originated by Garton's Ltd., Warrington, England, and apparently was first introduced into the United States prior to 1908 by a commercial seed company of Chicago, Ill. The strain of Garton No. 784 described by Etheridge (*61, p. 156*) was used in these classification studies, seed of which was obtained from him at Columbia, Mo., in January 1921.

Distribution.—None.

Oriental

Description.—Juvenile growth erect; plants very late, midtall to tall (90 to 130 cm.); culms small to midsized, weak, usually glabrous at the nodes; sheaths dark-green, usually glabrous, ligules absent; culm leaves midwide to wide, margins usually glabrous; peduncles small to midsized, straight, occasionally not fully exserted; panicles unilateral, erect or slightly drooping, midsized, very long, narrow, lower whorl of panicle branches arising at normal rachis nodes; rachises usually flexuous, nodes 5 to 7; branches long, ascending, pectinate in attitude, scabrous; spikelets usually numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 24 mm. long, 5 to 7 mm. wide, 8- to 10-veined, light-green and somewhat glaucous before maturity; grains slender to midplump; lemmas black; first lemmas short to midlong (15 to 18 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous or sparsely hairy, midlong (2.0 to 2.5 mm.). Spikelets and florets of Oriental are shown in figure 143.

FIGURE 143.—Spikelets and florets of Oriental. (× 1⅛.)

Oriental, a spring oat, is distinct in having black lemmas and no ligules. It is a rather tall, very late oat, with very long, narrow, slightly drooping side panicles and short to midlong and mostly awnless lemmas. Oriental is primarily of taxonomic interest.

History.—Oriental (C. I. 1598) was obtained by the United States Department of Agriculture in 1917 from George M. Reed, then head of the Department of Botany, University of Missouri. He obtained it, along with other varieties, from Franc Bubak, Director of the Botanical Garden, Tabor, Bohemia. This variety was received under the name "*Avena sativa* L. var. *nigra*." However, being a liguleless and distinct variety of black oats with unilateral panicles, it was

named "Oriental." Oriental may be the progenitor of the other ligulelss varieties of side oats described herein. It was not described by Etheridge (*61*) or Marquand (*107*).

Distribution.—None.

Synonym.—*Avena sativa* L. var. *nigra.*

Black Rival

Description.—Juvenile growth erect; plants midseason to late, short to midtall (60 to 120 cm.); culms large, stiff, usually glabrous at the nodes; sheaths dark-green, glabrous or slightly hairy; ligules present; culm leaves wide, margins ciliate; peduncles large, straight, occasionally not fully exserted; panicles unilateral, erect, midsized, midlong, midbroad, lower whorl of panicle branches usually arising at secondary rachis nodes; rachises very flexuous, nodes 5 to 7; branches midlong to long, ascending, somewhat confused in attitude, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 26 mm. long, 7 to 10 mm. wide, 9- to 11-veined, dark-green and glaucous before maturity; grains plump, many double; lemmas brownish-black to black; first lemmas short to midlong (14 to 17 mm.), glabrous; basal hairs few to several, short; awns few to common, nontwisted to twisted and subgeniculate, 20 to 30 mm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 144.

Black Rival, a spring oat, is best recognized by its side panicles in which the lower whorl of panicle branches usually arises at secondary rachis nodes, or so-called false nodes, and by its short to midlong, brownish-black to black lemmas and thick-hulled plump grains, many of which are double. Black Rival is primarily of taxonomic interest.

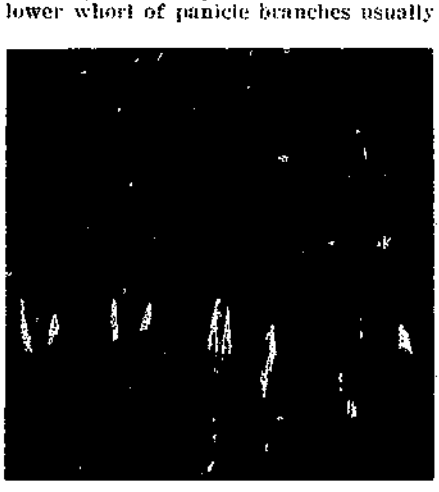


FIGURE 144.—Spikelets and florets of Black Rival. (× 1½.)

History.—Black Rival (C. I. 807) is said to have been originated and distributed by Garton's Ltd., Warrington, England, and the varieties involved in its parentage to include Abundance, Black Tartar, Pioneer, and Potato. It has not been possible to confirm this history, but Black Rival is similar in many characters to Black Tartar. The stock of seed used in the present classification studies was obtained from the New Zealand Exhibit at the Panama Pacific International Exposition held at San Francisco, Calif., in 1916.

Distribution.—Grown to a very limited extent.

Synonym.—Supreme.

Supreme apparently was first introduced into the United States from Scotland about 1919. According to Marquand (*107, p. 29*), Supreme was developed by Garton's Ltd., Warrington, England, from a cross between Bountiful and Abundance. The company released it for commercial production in 1915. Supreme attained no economic importance in the United States, being grown on only a few farms in Oregon and Washington. Under some conditions Supreme ripens a little earlier and grows a little taller than Black Rival, the type variety. It is somewhat variable in certain plant and grain characters.

Black Tartar

Description.—Juvenile growth erect; plants midseason to late, midtall to tall (90 to 130 cm.); culms midsized to large, stiff, usually glabrous at the nodes; sheaths dark-green, usually glabrous, ligules present; culm leaves wide, margins usually glabrous; peduncles large, straight, usually fully exserted; panicles unilateral, erect, midsized, midlong, midbroad, lower whorl of panicle branches arising at secondary or normal rachis nodes; rachises very flexuous, nodes 5 to 7; branches midlong to long, ascending, somewhat confused in attitude, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 23 to 27 mm. long, 6 to 8 mm. wide, 9- to 10-veined, dark-green before maturity; grains slender to midplump, some double; lemmas brownish-black to black; first lemmas midlong to long (16 to 19 mm.), glabrous; basal hairs few to several, short; awns few to common, nontwisted to twisted and subgeniculate,

15 to 35 mm. long; caryopses 7 to 9 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments usually sparsely hairy, midlong to long (2 to 3 mm.). Spikelets and florets are shown in figure 145.

FIGURE 145.—Spikelets and florets of Black Tartar. (× 1⅛.)

Black Tartar, a spring oat, is distinguished primarily from Black Rival in usually having only a few so-called false nodes, slightly longer lemmas, and more slender grains with fewer double, or bosom, oats. Under most conditions, the culms of Black Tartar also grow a little taller and the peduncles are usually more fully exserted. These characters serve to distinguish Black Tartar from Black Rival. Since it is one of the oldest known varieties with side panicles, Black Tartar is of historical and taxonomic interest.

History.—Black Tartar (C. I. 991), one of the oldest varieties of side oats, was introduced into England from an oriental source about the middle of the 18th century (*59*). It was brought to the United States from England and is mentioned in the earliest records of experimental agriculture of the United States Government (*199, p. 47*). It was reported in the varietal survey of 1919.

Distribution.—Grown to a very limited extent.

Synonyms.—Black Beauty, Black Egyptian, Black Prolific, Garton Black, Mold's Enobled.

The Black Beauty, Black Egyptian, and Black Prolific strains probably are of English origin. Garton Black is a strain of the Black Tartar oat introduced by Garton's Ltd., Warrington, England. Mold's Enobled is an English selection of Black Tartar and was grown in New York as early as 1879 (*1, p. 567*). Not one of the five named strains classified as synonyms of Black Tartar in this classification study has been of any economic promise in the United States.

Sir Douglas Haig

Description.—Sir Douglas Haig, a spring oat, is similar to Black Tartar in most plant and grain characters, except in growing a little taller and in having larger stems and lemmas. Some of the top spikelets have a tendency to be multiflorous. It is a somewhat variable variety, and it is mainly of taxonomic interest.

History.—Sir Douglas Haig (C. I. 1987) was originated by Garton's Ltd., Warrington, England, as a selection from a cross between Supreme, a somewhat variable black oat with side panicles, and a naked oat, probably of the Chinese (hull-less) type. Oldaker (*121*) reported on Sir Douglas Haig as a promising variety for growing in Tasmania.

Distribution.—None.

Garton Gray

Description.—Juvenile growth erect; plants late, midtall to tall (90 to 140 cm.); culms midsized to large, fairly stiff, usually slightly hairy at the nodes; sheaths dark-green, glabrous, usually somewhat glaucous, ligules present; culm leaves midwide, margins usually glabrous; peduncles large, straight, occasionally not fully exserted; panicles unilateral to semiunilateral, drooping, midsized, midlong, midbroad, lower whorl of panicle branches usually arising at normal rachis nodes; rachises somewhat flexuous, nodes 5 to 7; branches midlong, ascending, somewhat confused in attitude, scabrous; spikelets few to numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 28 mm. long, 6 to 8 mm. wide, usually 9-veined, dark-green and somewhat glaucous before maturity; grains midplump to plump; lemmas dark-gray (mottled); first lemmas midlong to long (16 to 20 mm.), glabrous; basal hairs few to several, short; awns several to numerous, nontwisted to twisted and subgeniculate, 15 to 35 mm. long; caryopses 8 to 10 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong (1.5 to 2.5 mm.). Spikelets and florets are shown in figure 146.

Garton Gray, a spring oat, is easily recognized by its distinct dark-gray, midlong to long lemmas; thick-hulled, midplump to plump grains; and midsized to

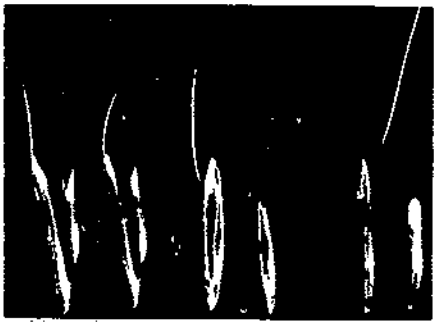


FIGURE 146.—Spikelets and florets of Garton Gray. (× 1.)

large, coarse culms. It is primarily of taxonomic interest.

History.—Garton Gray (C. I. 1804) appears to have been developed by Garton's Ltd., Warrington, England, but no record of its breeding is available (*107, p. 28*). The stock of seed of Garton Gray used in this classification study was obtained by the United States Department of Agriculture from a commercial seed company of Seattle, Wash.

Distribution.—Grown to a very limited extent.

Seizure

Description.—Juvenile growth erect; plants late, midtall to tall (90 to 140 cm.); culms midsized to large, fairly stiff, occasionally slightly hairy at the nodes; sheaths dark-green, usually glabrous, ligules present; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles unilateral, drooping, midsized, long, narrow, lower whorl of panicle branches arising at normal rachis nodes; rachises very flexuous, nodes 4 to 7; branches midlong, ascending, pectinate in attitude, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 25 to 30 mm. long, 5 to 7 mm. wide, usually 9-veined, dark-green and glaucous before maturity; grains slender; lemmas light-gray; first lemmas long to very long (18 to 22 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 8 to 10 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong to long (2 to 3 mm.). Spikelets and florets of Seizure are shown in figure 147.

Seizure, a spring oat, is readily distinguished from Garton Gray by its more slender grains and longer and lighter gray lemmas. Under some environments

FIGURE 147.—Spikelets and florets of Seizure. (× 1½.)

the gray color of Seizure does not always develop fully and may then be considered as a yellow oat. It was so classified by Etheridge (*61, p. 158*). Seizure is of taxonomic interest.

History.—The origin of Seizure (C. I. 1609) has not been determined. The variety was grown by the Ohio Agricultural Experiment Station at Wooster as early as 1886 (*52, p. 72*). It probably was introduced somewhat earlier by immigrants from Europe. Seizure formerly was grown in Pennsylvania and Ohio. Only 1,126 acres were reported as being grown in Pennsylvania in the oat varietal survey of 1919.

Distribution.—Grown to a very limited extent.

Garton Yellow

Description.—Juvenile growth erect; plants midseason to late, short to midtall (60 to 100 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, usually glabrous; ligules absent; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, occasionally not fully exserted; panicles unilateral, erect, small, short, narrow, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches short to midlong, erect, pectinate in attitude, scabrous; spikelets usually few, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 20 to 24 mm. long, 5.5 to 7.5 mm. wide, 8- to 10-veined, light-green and glaucous before maturity; grains midplump; lemmas yellow; first lemmas short to midlong (14 to 17 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 7 to 8 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 4.5 to 6.5 mm. long; second floret rachilla segments glabrous, short to midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 148.

Garton Yellow, a liguleless spring oat, is similar to Garton No. 748 in most characters except in color of lemmas, which

FIGURE 148.—Spikelets and florets of Garton Yellow. (× 1.)

is a distinct yellow. It differs from Golden Giant in usually having shorter culms, slightly smaller and narrower side panicles, shorter lemmas, plumper grains, and shorter second floret rachilla segments. Garton Yellow is primarily of taxonomic interest.

History.—Garton Yellow (C. I. 1612) was originated by the United States Department of Agriculture as a plant selection from Garton No. 748. During first few years the black oat, Garton No. 748, was grown in identification and classification nurseries, it contained some plants with yellow grains. These were isolated by the late C. W. Warburton and the writer and have been grown since as a distinct variety.

Distribution.—None.

Golden Giant

Description.—Juvenile growth erect; plants late, midtall to tall (90 to 130 cm.); culms midsized to large, fairly stiff, occasionally slightly hairy at the nodes; sheaths dark-green, usually glabrous, somewhat glaucous, ligules absent; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, usually full exserted; panicles unilateral, erect or slightly drooping, midsized, midlong to long, narrow, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, ascending, pectinate in attitude, scabrous; spikelets numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 26 mm. long, 5 to 7 mm. wide, 9- to 10-veined, light-green and glaucous before maturity; grains slender to midplump; lemmas yellow; first lemmas midlong to long (17 to 20 mm.), glabrous; basal hairs few or absent; awns common, usually dark-colored on lower parts, nontwisted to twisted and subgeniculate, 15 to 30 mm. long; caryopses 7 to 9 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments, occasionally sparsely hairy, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 149.

FIGURE 149.—Spikelets and florets of Golden Giant. (× 1⅛.)

Golden Giant, a spring oat, is distinct among the nonblack varieties with side panicles in having no ligules and in being a distinct yellow oat. Because of the ligueless character, Golden Giant is of considerable taxonomic interest.

History.—One lot of seed of Golden Giant (C. I. 1606) apparently was introduced into the United States from Vilmorin of France in 1887 by the W. Atlee Burpee & Co., Philadelphia, Pa. It is listed in their 1889 catalog (*20, p. 98*). Vaughan's Seed Store, Chicago, Ill., also imported seed of this variety even at an earlier date under the name of "Giant Yellow French," which was accompanied by the following statement of the French producers regarding its development (*201, p. 79*):

> It has been selected in our grounds since 1880 and may be recommended with confidence as the most prolific in existence. It is a most wonderful hybrid of the Yellow Flanders with our Hungarian oat . . . The grain is heavy, large, plump and entirely similar to that of the Yellow Flanders Oats or the Saline Oats which have been so very popular for years in France.

Distribution.—Grown to a very limited extent.

Synonyms.—Giant French Hybrid, Giant Yellow, Giant Yellow French, Jaune Géant à Grappes, Yellow Flanders, Yellow Tartar.

Giant French Hybrid (*99*), Yellow Flanders, and Jaune Géant à Grappes are strains of the variety grown in France. However, the name "Yellow Flanders" probably originated in England, as it apparently was first introduced into England from Flanders, France. Giant Yellow is another strain of this oat, the origin of which is obscure. The origin of the Yellow Tartar strain of this variety

is undetermined, although mentioned by some English writers.

Don de Dieu

Description.—Juvenile growth erect; plants early to midseason, short to midtall (70 to 110 cm.); culms small to midsized, usually slightly hairy at the nodes; sheaths dark-green, usually glabrous, ligules present; culm leaves midwide, margins usually glabrous or slightly ciliate; peduncles small, straight, occasionally not fully exserted; panicles unilateral, very drooping, midsized, very long, narrow, lower whorl of panicle branches arising at normal rachis nodes; rachises usually somewhat flexuous, nodes 5 to 7; branches midlong, very ascending, pectinate in attitude, scabrous; spikelets numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 22 to 28 mm. long, 5 to 7 mm. wide, usually 9-veined, light-green and glaucous before maturity; grains slender; lemmas reddish-yellow (creamy-white); first lemmas midlong to long (17 to 20 mm.), glabrous; basal hairs few or absent; awns few or absent; caryopses 7 to 9 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 5 to 7 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 150.

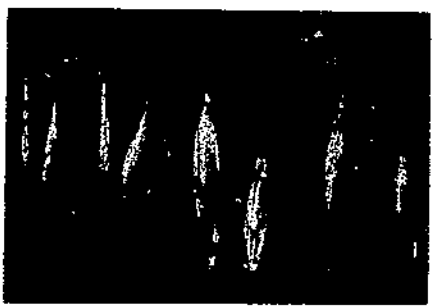


FIGURE 150.—Spikelets and florets of Don de Dieu. (× 1¼.)

Don de Dieu, a spring oat, is distinguished from Golden Giant and Garton Yellow by being earlier and in having ligules. It also differs from these varieties in having longer, narrower, and more drooping panicles and rather distinct reddish-yellow (creamy-white) lemmas.

History.—Don de Dieu (C. I. 2641) was first brought to the attention of oat specialists of Canada sometime during the 1930's by a farmer in Rimouski County, Quebec, who claimed that he had developed a new variety of oats. Its origin, however is not clear. Don de Dieu was widely advertised in Canada in 1938 and 1939 with extravagant claims that it would yield as much as 300 bushels to the acre. Results of varietal tests at Canadian experiment stations have shown Don de Dieu to be decidely inferior in yield to standard varieties such as Banner and Victory. It is a rather distinct type of side oats that apparently has not been described previously.

Distribution.—Grown to a very limited extent in the United States and in Canada.

Storm King

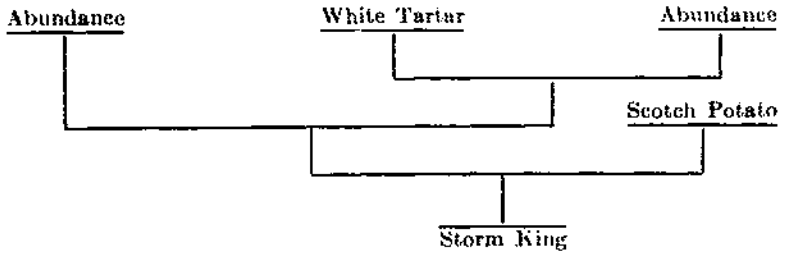
Description.—Juvenile growth erect; plants midseason, short (60 to 90 cm.); culms very large, stiff, usually glabrous at the nodes; sheaths dark-green, usually hairy, ligules present; culm leaves very wide, margins ciliate; peduncles large, straight, usually not fully exserted; panicles unilateral, erect, large, midlong, midbroad, lower whorl of panicle branches arising at normal or secondary rachis nodes; rachises very flexuous, nodes 5 to 7; branches long, ascending, confused in attitude, scabrous; spikelets few to numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 24 to 28 mm. long, 7 to 11 mm. wide, 9- to 10-veined, dark-green and glaucous before maturity; grains very plump, many double; lemmas yellowish-white to white; first lemmas short to midlong (15 to 18 mm.), no depressed dorsum, glabrous; basal hairs few or absent; awns few to common, nontwisted to twisted and subgeniculate, 15 to 35 mm. long; caryopses 6.5 to 8.5 mm. long; second lemmas 11 to 15 mm. long; awns absent; caryopses 4 to 6 mm. long; second floret rachilla segments glabrous, long (2.5 to 3.0 mm.). Spikelets and florets are shown in figure 151.

Storm King, a spring oat, is distinct in having short, very large, coarse culms with lower whorl of panicle branches usually arising at secondary rachis nodes. The very plump, thick-hulled grains, of which a large percentage are double, and

FIGURE 151.—Spikelets and florets of Storm King. (× 1⅛.)

yellowish-white to white lemmas aid in its identification.

History.—Storm King (C. I. 1602) was bred and introduced to the trade in 1899 by Garton's Ltd., Warrington, England. Marquand (*107, p. 33*) recorded the breeding of Storm King at Little Leigh, Cheshire, England, as follows:



Distribution.—Grown to a very limited extent.

Synonyms.—Mammoth. Mammoth Cluster, Senator, Storm Queen, Waverly.

Senator apparently is another selection from the cross which produced Storm King. It was so named by the producers, Garton's Ltd., Warrington, England. Mammoth is a strain of Storm King that was first reported as being grown on the farm of Kilby Kite, Cluny, Alberta, Canada. Cowdery (*43, p. 22*) in 1922 discussed this oat for western Canada. Mammoth Cluster is a strain of Storm King grown to a limited extent in the United States that was probably first grown in Canada. Storm Queen has been grown to a very limited extent in Oregon. According to Peter Nairn,[74] Salem, Oreg., this variety was sent to his father from San Francisco, Calif., where it was exhibited at the Panama-Pacific Exposition in 1920. Mr. Nairn believes it was first introduced into Canada from Garton's Ltd. or other English source. The parents of Waverly are said to be Potato, Chinese (hull-less), White Tartar, and Yellow Flanders and was bred by Garton's Ltd.

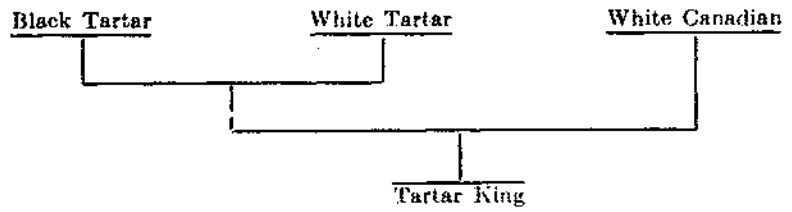
Tartar King

Description.—Similar to Storm King except for the following characters: Plants short to midtall (80 to 110 cm.); grains midplump to plump, few double; first lemmas midlong to long (16 to 19 mm.); awns few or absent.

Tartar King, a spring oat, differs morphologically from Storm King only in having slightly taller culms, slightly longer lemmas, less plump grains, with fewer double, or bosom, oats. Under some conditions these varieties are difficult to distinguish and are frequently confused. Spikelets and florets are shown in figure 152.

FIGURE 152.—Spikelets and florets of Tartar King. (× 1⅛.)

History.—Tartar King (C. I. 1599) was bred and introduced in 1899 by Garton's Ltd., Warrington, England. Marquand (*107, p. 34*) has recorded the varieties involved in its parentage as follows:



[74] Letter from Peter Nairn, dated November 20, 1926.

Distribution.—Grown to a very limited extent.

Synonyms.—Canada Cluster, Carter Prize Cluster, Long's White Tartar, Swiss Giant, Tartar Knight, White Plume.

The origin of the Canada Cluster strain has not been determined. However, Tartar King had been grown rather sparsely under this name in the New England and other Northeastern States, and also in Canada, where the strain apparently was originated by Carter & Co. This company also probably distributed Carter Prize Cluster, a strain of Tartar King, placed on the market in 1908 by another commercial seed company. Long's White Tartar was originated by a Mr. Long of Lebanon County, Pa., as a mass selection from Tartar King (*122*). The origin of the Swiss Giant and White Plume strains have not been determined. Very little Tartar King is grown under these names. Tartar Knight is a strain of Tartar King grown in England and may have originated as a selection of Tartar King.

Sparrowbill

Description.—Juvenile growth erect; plants late, midtall to tall (90 to 130 cm.); culms large, stiff, usually glabrous at the nodes, usually somewhat glaucous; sheaths dark-green, usually glabrous, ligules present; culm leaves midwide to wide, margins usually glabrous; peduncles midsized, straight, usually fully exserted; panicles unilateral, very erect, midsized, midlong, narrow, lower whorl of panicle branches arising at normal or secondary rachis nodes; rachises usually flexuous, nodes 5 to 7; branches short, ascending, confused in attitude, scabrous; spikelets numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation; glumes 18 to 24 mm. long, 6 to 8 mm. wide, 8- to 10-veined, light-green and glaucous before maturity; grains plump, few or none double; lemmas yellowish-white (pale-yellow) to white; first lemmas very short to short (12 to 14 mm.), depressed dorsum, glabrous; basal hairs few to several, short; awns few or absent (rare); caryopses 5.5 to 7.0 mm. long; second lemmas 7 to 11 mm. long; awns absent; caryopses 4 to 6 mm. long; second floret rachilla segments glabrous, short to midlong (1.5 to 2.0 mm.). Spikelets and florets are shown in figure 153.

Sparrowbill, a spring oat, is very distinct among the side oats in having very short to short first lemmas with depressed dorsum (dorsally incurved) and rather plump grains. The confused condition of the panicle branches and spikelets also serves to further differentiate the variety. Sparrowbill rarely produces any awns.

FIGURE 153.—Spikelets and florets of Sparrowbill. (× 1.)

History.—The origin of Sparrowbill (C. I. 1604) is undetermined. The stock of seed used in these studies was obtained from a collection of seeds from the New Zealand exhibit at the Louisiana Purchase Exposition, St. Louis, Mo., 1904. It was presented to the United States by the New Zealand Government through the late M. A. Carleton (P. I. 12879) (*197*). The variety probably was introduced by immigrants or other agencies many years earlier. Additional samples of the variety have been received at later dates from several State agricultural experiment stations. In the varietal survey of 1919, Sparrowbill was reported as being grown only in Oregon and Washington.

Distribution.—Grown to a limited extent.

Synonyms.—Shadeland Challenge, Shadeland Eclipse, Shadeland Wonder.

The Shadeland strains of Sparrowbill were all originated by N. C. Nairn, Amity, Oreg. The Shadeland Wonder was originated as a selection from Sparrowbill. This was followed by Shadeland Challenge, a reselection from Shadeland Wonder, which in turn was followed by Shadeland Eclipse, a reselection from Shadeland Challenge. It was estimated that Shadeland Eclipse was grown on 6 percent of the oat acreage of Oregon in 1935 (*156, p. 385*).

Schumacher No. 7

Description.—Juvenile growth erect; plants midseason to late, midtall to tall (90 to 130 cm.); culms midsized, stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, usually glabrous, ligules present; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles unilateral, usually erect, midsized, midlong, very narrow, lower whorl of panicle branches arising at normal rachis nodes; rachises occasionally slightly flexuous, nodes 5 to 7; branches midlong, very ascending, pectinate in attitude, scabrous; spikelets usually numerous, usual-

ly 2-flowered, separating by fracture; florets separating by disarticulation; glumes 15 to 22 mm. long, 5 to 7 mm. wide, 7- to 9-veined, light-green and glaucous before maturity; grains slender; lemmas yellowish-white to white; first lemmas very short to short (12 to 15 mm.), glabrous; basal hairs few to several, short; awns few or absent; caryopses 6 to 8 mm. long; second lemmas 7 to 9 mm. long; awns absent; caryopses 4 to 6 mm. long; second floret rachilla segments glabrous, long (2.5 to 3.0 mm.). Spikelets and florets are shown in figure 154.

FIGURE 154.—Spikelets and florets of Schumacher No. 7. (× 1.)

Schumacher No. 7, a spring oat, can be differentiated from White Tartar by its very narrow side panicles and short, yellowish-white to white lemmas.

History.—Schumacher No. 7 (C. I. 2895) was developed and distributed by William Schumacher, a private oat breeder of Readlyn, Iowa. A few panicles were obtained directly from Mr. Schumacher by H. C. Murphy in July 1930.

Distribution.—Grown to a very limited extent.

White Tartar

Description.—Juvenile growth erect; plants late, midtall to tall (90 to 130 cm.); culms midsized, stiff, usually glabrous at the nodes; sheaths dark-green, usually glabrous, ligules present; culm leaves midwide, margins usually glabrous; peduncles midsized, straight, fully exserted; panicles unilateral, usually very drooping, midsized, long, narrow, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches midlong, ascending, pectinate in attitude, scabrous; spikelets numerous, usually 2-flowered, separating by fracture; florets separating by disarticulation, glumes 22 to 28 mm. long, 5 to 7 mm. wide, 9- to 10-veined, light-green and somewhat glaucous before maturity; grains slender; lemmas white; first lemmas midlong (16 to 18 mm.), glaucous, glabrous; basal hairs few to several, short; awns few or absent; caryopses 7.5 to 9.5 mm. long; second lemmas 11 to 14 mm. long; awns absent; caryopses 5.5 to 7.5 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 155.

FIGURE 155.—Spikelets and florets of White Tartar. (× 1⅛.)

White Tartar, a spring oat, is distinguished from Tartar King by its taller plants, more slender culms, and more drooping panicles, and more slender grains. It is resistant to many physiologic races of stem rust of oats and has been used in hybridization experiments for breeding other stem-rust-resistant varieties.

History.—White Tartar (C. I. 1014) apparently was first introduced into the United States about 1850 or earlier. The history of the first introduction is undetermined. Official mention of the variety is made in the Report of the Commissioner of Patents (Agriculture) (*1849, p. 47*). According to a varietal survey in 1919, White Tartar was grown on about 2¼ million acres.

Distribution.—Grown to a limited extent in the Red River Valley area of North Dakota and Minnesota.

Synonyms.—Bliss Side, New Zealand, Tartarian, White Russian, White Tartarian.

Bliss Side, a typical strain of White Tartar, was placed on the market about 1880 by a commercial seed company of New York City. It is now of little economic importance. New Zealand, a strain of the White Tartar type, apparently was sent by a New Zealand farmer to a friend in Iowa in the early nineties (*10*). It is now little grown. Tartarian and White Tartarian are simply corruptions of the name "White Tartar." Apparently it was introduced into Russia and then brought to the United States under the name "White Russian." White Tartar is better known under the name "White Russian" in the Red River Valley area of North Dakota and Minnesota, where it is still grown to some extent, primarily because of resistance to stem rust.

Green Mountain

Description.—Similar to White Tartar except for the following characters: Plants midseason to late; awns common, nontwisted to twisted and subgeniculate, 25 to 30 mm. long. Spikelets and florets of Green Mountain are shown in figure 156.

FIGURE 156.—Spikelets and florets of Green Mountain. (× 1⅓.)

Green Mountain, a spring oat, differs from White Tartar only in having some awns and in being a little earlier under many environments. Like White Tartar it is resistant to many races of stem rust. Green Mountain is frequently confused with White Tartar.

History.—Green Mountain (C. I. 1892) apparently was placed on the market in Canada about 1910 by a commercial seed company of Hamilton, Ontario. It is said to have originated from a cross between Mortgage Lifter and White Russian. Its similarity to White Tartar (White Russian) parent tends to confirm this origin. Green Mountain was reported as White Tartar in the 1919 varietal survey.

Distribution.—Grown to a very limited extent.

Marvelous

Description. Juvenile growth erect; plants late, midtall (to tall (80 to 130 cm.); culms large, stiff, glabrous or slightly hairy at the nodes; sheaths dark-green, usually hairy, ligules present; culm leaves very wide, margins usually ciliate; peduncles large, straight, usually fully exserted; panicles unilateral to semiunilateral, drooping, large, long, midbroad to broad, lower whorl of panicle branches arising at normal rachis nodes; rachises usually slightly flexuous, nodes 5 to 7; branches long, very ascending, confused in attitude, scabrous; spikelets numerous, 2- to 3-flowered, separating by fracture; florets separating by disarticulation; glumes 28 to 35 mm. long, 7 to 10 mm. wide, usually 10-veined, light-green and glaucous before maturity; grains midplump to plump; lemmas white; first lemmas long to very long (19 to 25 mm.), glabrous; basal hairs few to several, short; awns common, usually dark-colored on lower parts, nontwisted to twisted and subgeniculate, 15 to 35 mm. long; caryopses 8 to 10 mm. long; second lemmas 12 to 16 mm. long; awns absent; caryopses 6 to 8 mm. long; second floret rachilla segments glabrous, midlong (2.0 to 2.5 mm.). Spikelets and florets are shown in figure 157.

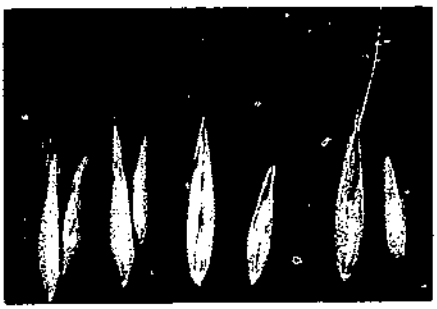
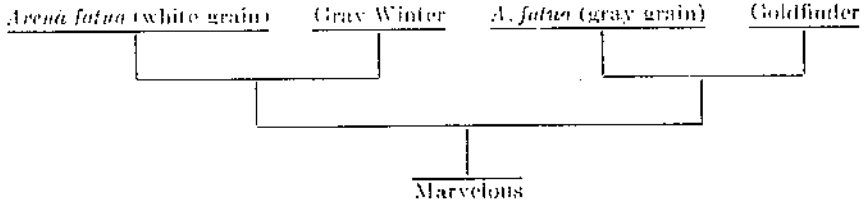


FIGURE 157.—Spikelets and florets of Marvelous. (× 6/5.)

Marvelous, a spring oat, is recognized by its very long glumes and long to very long lemmas. This character makes it distinct among varieties with side panicles. Under some conditions many of the apical spikelets in Marvelous are multiflorous. It is a variable variety.

History.—Marvelous (C. I. 1999) is another one of the creations and introductions from Garton's Ltd., Warrington, England. They introduced it to the trade in 1921. According to Marquand (*107, p. 31*), the varieties involved in its parentage are as follows:



Distribution.—None.

Synonyms.—Leader, New Banker, Yielder.

None of these strains is grown on large acreages in the United States. Leader was developed and introduced by Garton's Ltd. in 1913. The varieties involved in its breeding are Abundance, Chinese (hull-less), and Waverly. Leader is a little earlier than Marvelous and has a tendency to produce some 4-flowered spikelets and may not be altogether a fixed variety. However, it is classified as a distinct variety by Marquand (*107, p. 32*). The origin of New Banker is undetermined, but it probably was first placed on the market by a Canadian seed company. Yielder (*107, p. 31*) was selected from a cross between Waverly and Tartar King by Garton's Ltd. It was first released in England in 1909 from where seed was introduced into the United States. Yielder has slightly shorter glumes than Marvelous, and, like Leader, it has lacked productiveness and uniformity of plant characters when grown in the United States. Consequently it is of no economic importance.

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INDEX TO SPECIES, VARIETIES, AND SYNONYMS

Common and botanical names of species are in italic capitals; recognized varieties are in capitals; similar varieties and varietal synonyms in capitals and lower case. Of the two-page references given for recognized varieties, the first refers to the key and the second to the description, history, distribution, and synonomy. Where two or more page numbers are given for a synonym, the name is a synonym of more than one recognized variety.

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