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Technical Bulletin No. 1083 March 1954

UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

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NEED FOR CLASSIFICATION

The varieties of wheat grown in the United States show a great diversity of type. This diversity is natural, as wheat is produced commercially in most of the 48 States under a wide range of environmental conditions. More than 200 distinct varieties are grown. Many of these are adapted only locally, whereas others are well adapted to a wide range of varying conditions. Adaptation of varieties is an important factor, as it affects the yield and profitableness of the crop and the standardization of varieties. The choice of varieties for specific conditions and purposes is therefore usually given careful consideration by growers. The choice is partly dependent, however, upon the determination of identity.

The identification of varieties requires some knowledge of the appearance of plant and kernel and is assisted by information regarding history or distribution. Wheat varieties are most generally designated by names, which are established through publication and usage. Confusion in names is frequent in the United States, where the number of varieties is very large. This confusion occurs in two principal ways: (1) The same name is applied to distinctly different varieties in different parts of the country, and (2) the same

[1] Received for publication April 22, 1953. This bulletin is a revision of and supersedes Department Bulletin 1074, Classification of American Wheat Varieties, Technical Bulletin 459, Classification of Wheat Varieties Grown in the United States, and Technical Bulletin 795, Classification of Wheat Varieties Grown in the United States in 1939.

variety is grown under several different names in different parts of the country or even in the same area. Identification is difficult in cases of similar or closely related varieties and is confused by the multiplicity of names. Inability to identify varieties leads to duplication in varietal experiments and the fraudulent or unknowing exploitation of old varieties under new names.

There is need, therefore, for a practical and usable system of classification that will standardize the varietal nomenclature and enable growers to identify varieties with which they are concerned. The purpose of this bulletin is to provide such a classification of the wheat varieties that are grown commercially in the United States or may be so grown soon. The classification has been made by using only such characters as can be distinguished by the naked eye, no instrument other than a measuring rule having been used in the investigations. The names of varieties have been standardized insofar as practicable in accordance with a code of nomenclature.

PREVIOUS INVESTIGATIONS

Foreign Classifications

The existence of many different varieties of wheat has been recognized for more than 2,300 years. Theophrastus (*206, p. 167*),[2] a pupil of Plato, in his Enquiry into Plants, written about 300 B. C., states:

> There are also many kinds of wheat which take their names simply from the places where they grow, as Libyan, Pontic, Thracian, Assyrian, Egyptian, Sicilian. They show differences in color, size, form, and individual character, and also as regards their capacities in general and especially their value as food.

[2] Italic numbers in parentheses refer to Literature Cited, p. 158.

Theophrastus mentioned many of the differences between these kinds of wheat. In the writings of Varro, Pliny, and Columella, in the first century B. C. and the first century A. D., the observations of Theophrastus were repeated, rearranged, and amplified. The following notes, based on the writings of Varro and others, as well as those of Columella, were presented in the translation, in 1745, of Columella's book entitled "Of Husbandry" (*62, p. 60*):

> *Triticum*, common bare wheat, which has little husk upon it, was, according to *Varro*, a name given formerly to all sorts of grain beaten or bruised out of ears by trituration or threshing; but afterwards it was given to a peculiar species of grain, of which there are many sorts, which take their name from the places where they grow; as *African, Pontic, Assyrian, Thracian, Egyptian, Sicilian*, etc., which differ from one another in colour, bigness, and other properties, too tedious to relate. One sort has its ears without beards, and is either of winter or summer. Another sort is armed with long beards, and grows up sometimes with one, sometimes with more ears. Of these the grains are of different sorts: some of them are white, some reddish, some round, others oblong, some large, others small. Some sorts are early ripe, others late in ripening; some yield a great increase, some are hungry, and yield little; some put forth a great ear, others a small. One sort stays long in the hose (*folliculo*); another frees itself very soon out of it. Some have a small stalk or straw; others have a thick one, as the *African*. Some are cloathed with few coats, some with many, as the *Thracian*. Some grains put forth only one stalk, some many stalks. Some require more, some less time to bring them to maturity. For which reason some are called *trimestrian*, some *bimestrian;* and they say, that, in *Euboea*, there is a sort, which may be brought to perfection in 40 days; but most of these sorts, which ripen in a short time, are light, unfruitful, and yield very little, tho' they are sweet and agreeable to the taste and of easy digestion.

In the early Roman literature mentioned, reference is found to two groups of wheat; namely, *triticum* and *adoreum*, or *far*. Col-

umella referred to the *far* as bearded wheat. The grain of *triticum* was separated from the chaff in threshing, whereas that of *far* was not, indicating that the former consisted of true wheats, but the latter was emmer or spelt.

Columella recognized three types of *Triticum*, *robus* (red), *siligo* (white), and *trimestrian* (spring), and in addition four types of bearded wheat (spelt or emmer), viz. (*62, pp. 61–62*):

> *Clusinian*, of a shining, bright, white colour; a bearded wheat, which is called *venuculum*. One sort of it is of a firy red colour, and another sort of it is white; * * *. The *trimestrian seed*, or that of 3 months' growth, which is called *halicastrum* * * *.

It is evident from these quotations that many of the leading characters of the wheat plant were recognized in this early period. What attention was given to studies of wheat during the Dark Ages no one can say. With the revival of learning the botanists and medical men began the publication of the folio and royal octavo herbals, many of them illustrated with woodcuts. In these, wheat species were included, the forms mostly being those described by Theophrastus, Pliny, and Varro, but from time to time new ones were added. There is little advantage in trying to guess what particular form of common wheat each so-called species represented. More recent botanical writers described species that can now be recognized. Principal among these writers was Tournefort (*209*), who in 1719 listed 14 species of *Triticum*.

The classification of wheat practically began with the work of Linnaeus in 1753. In his Species Plantarum (*134, p. 85*) he described seven species of *Triticum: T. aestivum, T. hybernum, T. turgidum, T. spelta, T. monococcum, T. repens,* and *T. caninum*. The two latter species have since been included in another genus. In the second edition of the Species Plantarum, published in 1762 (*135, p. 126*) he described six species that are still included in the genus *Triticum: T. aestivum, T. hybernum, T. turgidum, T. polonicum, T. spelta,* and *T. monococcum*, the species *T. polonicum* having been added. Linnaeus divided the common wheat into two species—*T. aestivum*, awned spring, and *T. hybernum*, awnless winter—apparently believing that all spring wheats were awned and all winter wheats awnless. Writers who followed him usually have not recognized these distinctions.

Lamarck in 1778 (*127*) created the species *T. sativum* to include both the species *T. aestivum* and *T. hybernum* that Linnaeus had adopted. Each species and subspecies was described according to the presence or absence of awns, the color and covering of the glumes, the color, size, and density of the kernels, the solidity of the stem, and several other characters.

Villars in 1787 (*214*) divided the common wheats into two species, *T. vulgare* and *T. touzelle*. The latter consisted of awnless wheat having white kernels.

Schrank in 1789 (*182, pp. 387–389*) arranged the cultivated wheats in three species. For common wheat he established the name "*Triticum cereale*" and placed *T. aestivum* and *T. hybernum* under it as varieties. The second species was *T. spelta* and the third *T. dicoccum* Schrank, the cultivated emmer.

Desfontaines in [1798] (*67, p. 114*) established the species *T. durum* for the group of wheats having long awns and long vitreous kernels.

Host in 1805 (*107, v. 3*) was the first to include the *T. aestivum* and *T. hybernum* of Linnaeus as one species under the name *T. vulgare*. Host's name *T. vulgare* is still com-

monly used by geneticists, agronomists, and cereal taxonomists for the species *T. aestivum*. He also described and named the species *T. compactum* to include the club wheats (*107, v. 4*) and in addition recognized 10 other species of the genus *Triticum* (*107, v. 3, v. 4*).

Seringe in 1818 (*187*) arranged the common and club wheats together into 10 groups, based on lax or dense and awned or awnless spikes, white or brownish kernels, and glabrous or pubescent glumes. He listed varieties from Switzerland, France, Germany, and England.

Metzger in 1824 (*141*), at Heidelberg, followed essentially the same system as Seringe, but in addition considered winter or spring habit of growth. The 10 groups of Seringe were further subdivided, making 18 groups. The kernels were described as white, yellow, and reddish.

Metzger in 1841 (*142*) reedited his classification of 1824, making some changes and adding more varieties.

Seringe in 1841 (*188*) published a revision of his previous work of 1818, in which he classified and partly described a large number of varieties of wheat.

Alefeld in 1866 (*7*) classified the wheats into two genera and species, *Triticum vulgare* and *Deina polonica*. The latter contained four subspecies or varieties of Polish wheats, *T. polonicum*, and the former was divided into many subspecies and varietal groups containing all other species of *Triticum*. Each of these was described in detail.

Heuzé in 1872 (*99*) grouped the wheats into 7 species. He listed 700 varietal names of wheat, 602 of which belong to the species *T. sativum*, which included both common and club wheats. He described 47 varieties in this species, and the remaining 555 names were considered as synonyms.

Körnicke in 1873 (*125*) and Körnicke and Werner in 1885 (*126*) prepared the most complete classification of wheat yet published. They followed Alefeld's system of applying Latin names to the botanical groups. The groups keyed by them included 22 of *vulgare*, 21 of *compactum*, 26 of *turgidum*, 24 of *durum*, 12 of *spelta*, 20 of *dicoccum*, 21 of *polonicum*, and 4 of *monococcum*. Named varieties included in each botanical group were described in detail, and the history, synonyms, and source of each were given. Much of this latter information had been published in the works of Alefeld and Heuzé.

Harz in 1885 (*94*) classified and described a large number of wheats in a manner similar to that of Körnicke and Werner. The common and club wheats were considered as a single species.

Hackel in 1890 (*91*) classified the genus *Triticum* according to a key very similar to the one adopted by Körnicke and Werner. Hackel recognized three species, *sativum* Lam., *monococcum* L., and *polonicum* L.; and three races of *sativum*, namely, *spelta*, *dicoccum*, and *tenax*. In the latter he included *vulgare*, *compactum*, *turgidum*, and *durum* as subraces.

Vilmorin in 1889 (*215*) grouped the wheats into 50 sections, according to their leading characters. Each section was briefly described and the synonyms were given. The common and club wheats were considered as one species.

Eriksson in 1895 (*74*) subdivided the botanical groups of Körnicke and Werner into smaller groups, which he called subvarieties, based chiefly on the density of the spike, the thickness of the kernel, and the length of the rachis. He also gave an excellent review of the literature on wheat classification.

Heuzé in 1896 (*100*) published a second edition of his Les Plantes Céréales, in which rather complete histories and descriptions of the varieties of wheat were included.

Cobb in 1896 (*57*) keyed 54 varieties of wheat that he was growing in New South Wales, Australia, using the leading plant, spike, and kernel characters. In 1905 (*60*) he proposed to classify wheat varieties by a microscopic examination of the aleurone layer.

Howard and Howard in 1909 (*109*) classified the wheats of India largely according to the methods of Körnicke and Werner and of Eriksson. They (*108*) also considered in detail the characters used in classification.

Richardson in 1913 (*171*) described many of the wheats of Australia and gave the history of each variety. He did not arrange them in a classified order.

Flaksberger in 1915 (*77*) published extensive treatises on the taxonomy of Russian wheat forms.

The Union of South Africa in 1919 (*192*) published descriptions and synonyms of the wheat varieties of South Africa and also designated the areas where the varieties should be grown in that country.

Ducellier in 1920 (*72*) published a classification and description of the wheats of the Hoggar and oasis regions of Algeria. Only a few varieties were fully described.

The Institute of Science and Industry, of Australia, in 1920 (*12*) classified and described 48 of the leading wheats of Australia in a manner similar to that used by the writers of this bulletin.

Percival in 1921 (*162*) described and classified a large number of wheat varieties of the world and discussed fully the morphology of the wheat plant.

The Institute of Science and Industry, of Australia, in 1923 (*13*) revised and extended the classification of 1920 to include 82 varieties. Data were also presented on the agricultural characters of these varieties.

Zhukovsky in 1928 (*233*) described a new species, *T. timopheevi* Zhuk., which has 14 haploid chromosomes and is very resistant to several diseases.

Newman in 1928 (*149*) discussed the value of characters used by Clark, Martin, and Ball (*48*) for classifying Canadian varieties and reported extensive studies on the effect of environment on glume characters and on variability in Marquis seed stocks.

Papadakis in 1929 (*158*) published a classification of the wheats grown in Greece.

Miège in 1930 (*144*) described the principal varieties of common and durum wheat grown in Morocco.

Vavilov and associates in 1931 (*213*) published a contribution to the knowledge of the 28 chromosomes group of cultivated wheats.

Gurney in 1932 (*90*) published a key and detailed descriptions for the wheat varieties grown in South Australia.

Histories and descriptions and colored plates of heads of the wheat varieties developed by Strampelli are given in the appendix of a report by the National Institute of Genetics as Related to the Cultivation of Cereals in Rome in 1932 (*200*).

McMillan in 1933 (*139*) presented a genealogical chart showing the history of Australian wheat varieties.

Vasconcelos in 1933 (*212*) described the native and other varieties of wheat that have been grown in Portugal for a long period. Varieties of the following species were included: *vulgare, compactum, turgidum, durum,* and *polonicum.*

Voss in 1933 (*219*) described and grouped the wheat varieties of Germany.

Zhukovsky in 1933 (*234*) published a botanical classification of the wheat varieties of Anatolia.

Hudson in 1933 and 1934 (*110*) described and classified the wheat varieties of England.

Kalt in 1934 (*118*) described briefly the wheat varieties grown in Chile.

Flaksberger in 1935 (*78, 79*) presented the results of extensive studies on the origin and classification of the species and varieties of wheat of the world.

Jonard in 1936 (*115*) classified and gave the origin, synonomy, and description of the common wheats grown in France.

Newman, Fraser, and Whiteside in 1936 (*150*) classified and described the spring wheat varieties of Canada and gave a brief account of the origin and distribution of each. Their work was revised in 1939 and 1946.

Barbacki and coworkers in 1937 (*20*) classified and described the wheats of Poland.

Wenholz and others in 1938–41 (*225*), in a series of articles beginning in the November 1, 1938, issue of the Agricultural Gazette of New South Wales, gave a brief history of the named varieties of wheat grown in Australia.

Maugini in 1939 (*140*) described the wheats of Abyssinia and Eritrea, which included the following species: *dicoccum*, *durum*, *pyramidale* Perc., *turgidum*, *polonicum*, *vulgare*, and *compactum*.

Parera and Palau in 1939 (*159*) classified, described, and gave a brief account of the origin of the wheat varieties grown in Argentina.

Flaksberger and coworkers in 1939 (*80*) revised and enlarged his earlier publications on the species and varieties of wheat of the world. He and his associates have given more attention to a study of the species of wheat than other recent workers, and his classification of the species of the genus *Triticum* is followed by the writers.

Patrón in 1940 (*160*) described 35 varieties of wheat grown commercially in Argentina.

The adaptation, disease reaction, quality, and a description of the varieties of wheat grown in Chile was presented by the Ministry of Agriculture (*38*) about 1941.

Horovitz (*106*) in 1945 described the principal varieties of wheat grown in Argentina.

Jonard in 1951 (*116*) presented the results of studies on the morphological and physiological characteristics and on the diseases of wheat. He also discussed the adaptation of varieties, presented keys for their identification, and described each variety.

Domestic Classifications

Harmon in 1844 (*92*) published descriptions and histories of about 30 varieties of wheat that he had grown in Monroe County, N. Y.

Klippart in 1858 (*124*) described a large number of wheat varieties grown in Ohio and grouped them into a partly classified order.

Todd in 1868 (*208, p. 88*) described a number of wheat varieties, most of the descriptions, however, being obtained from agricultural literature of the time. He suggested that the Government "take hold of this subject [the nomenclature of wheat] in a proper manner and establish a common standard of merit and an intelligible description of each variety * * *."

Killebrew in 1877 (*123*) described a number of American wheats, most of which had been described previously by Klippart or Todd. He grouped the varieties into two families, winter wheats and spring wheats. The winter wheats were divided into six classes based upon their kernel characters, white, amber, and red, and upon the

awned or awnless character. The spring wheats, which were all regarded as being awned, were placed in three classes, with white, amber, or red kernels.

Tracy in 1881 (*210*) listed a number of wheat varieties grown by him at the Missouri Agricultural Experiment Station. The varieties were partly described, showing the "bearded" or "smooth" heads and the color and size of the kernels. He mentions several varietal names as being synonyms.

Devol in 1887 (*68*) and in 1888 (*69*) published a classification of the wheat varieties being grown at the Ohio Agricultural Experiment Station. This classification was further developed by Hickman (*102*), who in 1889 divided the varieties into eight morphological groups.

Plumb in 1889 (*163*) described a large number of wheat varieties, chiefly American, and gave the histories of many of them.

Blount in 1892 (*22*) listed 478 varieties of wheat that he was growing experimentally in New Mexico. Histories of some of these were given.

Carleton in 1900 (*35*) summarized the varietal information of that time, listed about 350 varieties, gave their source by countries and their principal characters, and grouped them by districts of the United States to which they were best adapted.

Scofield in 1902 (*183*) classified and described a large number of durum wheats grown in Algeria, many of which were introduced into the United States about 1901. He also described the characters used in classification. In 1903 Scofield (*184*) prepared a detailed list of characters to be used in the description of wheat varieties. He did not publish the descriptions of any varieties at that time. The application of the terminology was partly illustrated by plates accompanying the article.

Williams in 1905 (*228*) listed and partly described about 60 varieties of wheat that were under study at the Ohio Agricultural Experiment Station at that time.

Hume, Center, and Hegnauer in 1908 (*111*) briefly classified the wheat varieties grown in experiments in Illinois and gave the history and partial descriptions of some of the Russian and American varieties.

Scherffius and Woosley in 1908 (*180*) published illustrations of 36 varieties of wheat grown by the Kentucky Agricultural Experiment Station.

Noll in 1913 (*152*) presented a tabular description of varieties grown by the Pennsylvania Agricultural Experiment Station.

Leighty in 1914 (*133*) gave a list of the leading varieties of wheat grown in the eastern half of the United States, arranging them in classified groups by kernel and spike characters.

Schafer and Gaines in 1915 (*178*) recorded brief descriptions of the principal wheat varieties of Washington, together with their histories.

Nelson and Osborn in 1915 (*148*) gave a brief tabular description of the wheat varieties grown at the Arkansas Agricultural Experiment Station during the period from 1908 to 1914.

Reisner [3] in 1915 compiled much valuable information on the description and history of varieties grown in New York.

Ball and Clark in 1915 (*14*) presented keys to the groups of hard red spring wheat and the durum wheats grown in the United States and described and gave the histories of the more important varieties.

Carleton in 1916 (*37*) listed the

[3] REISNER, JOHN H. WHEAT IN NEW YORK, 1915. [Unpublished thesis, Cornell University.]

leading wheat varieties of the world, including American varieties. They were grouped into the botanical groups used by Körnicke and Werner. No attempt was made to distinguish between the closely related agricultural varieties.

Stanton in 1916 (*196*) grouped a large collection of wheat varieties grown in experiments in Maryland and Virginia in accordance with some of the most obvious taxonomic characters.

Jones in 1916 (*117*) presented a brief key to the groups of common spring and durum wheats grown in experiments in Wyoming.

Ball and Clark in 1918 (*17*) published a key to the groups and varieties of durum wheat grown in the United States.

Grantham in 1918 (*89*) listed a large number of varieties that were being grown at the Delaware Agricultural Experiment Station and stated whether they were bearded or smooth, the color of the grain and chaff, the height of the plant, and the weight of the kernels.

Clark, Stephens, and Florell in 1920 (*56*) gave a tabular description of more than 150 samples of Australian wheat varieties grown in experiments in the Pacific coast area of the United States.

Clark, Martin, and Smith in 1920 (*50*) keyed the groups of common spring and durum wheat grown in experiments in the northern Great Plains area of the United States and gave the histories of the principal varieties.

Stewart in 1920 (*198*) presented keys and brief descriptions of the commercial wheat varieties grown in Utah.

Clark, Martin, and Ball in 1922 (*48*) presented detailed keys, descriptions, histories, distributions, and synonyms of the wheat varieties grown commercially in the United States.

Schafer, Gaines, and Barbee in 1926 (*179*) keyed and presented tabular descriptions of the wheat varieties of Washington.

Hill in 1930 (*104*) presented the results of a survey showing the percentage of the total production for the wheat varieties grown in each county in Oregon in 1929.

Gaines and Schafer in 1931 (*85*) presented results of a similar survey for Washington, giving the percentages of the total acreage and production for the varieties in each county in that State in 1929.

The Northwest Crop Improvement Association of Minneapolis, Minn. (H. R. Sumner, secretary), issued a Dictionary of Spring Wheat Varieties in the United States in 1933 (*154*). Revisions were issued (H. D. Putnam, secretary) in 1941 (*155*) and 1949 (*156*).

Gaines and Schafer in 1936 (*86*) presented results of a survey showing the production of the wheat varieties grown in each county in Washington in 1934.

Reitz in 1945 (*168*) gave detailed descriptions and enlarged drawings of the kernels of the important varieties of hard red winter and soft red winter wheat grown in Kansas.

Crawford in 1947 (*63*) gave the origin, distribution in 1946, description, and identifying characteristics and milling and baking characteristics of the varieties grown in the Pacific Northwest.

Dines in 1948 (*70*) studied the kernel characteristics of the hard red winter wheats and published very accurate and useful drawings and descriptions of each of the important varieties.

Summary of Previous Classifications

From the beginning of botanical classification there was a tendency to regard the different forms of *Triticum* as distinct species.

Toward the end of the 19th century, there became evident a tendency toward the more reasonable view that comparatively few species were involved and that the evident major groups were mostly to be regarded as subdivisions of the species *sativum* of Lamarck or *vulgare* of Host.

The designating of botanic species of wheat was carried to great lengths by the botanists of 100 to 200 years ago, who did not recognize that the characters sufficient to separate species of wild plants were sufficient to separate only agronomic and horticultural varieties of domesticated plants. Before this fact was recognized and botanists very largely had ceased to deal with the forms of cultivated plants, some 50 or 60 supposed species of wheat had been described.

In the works of most of the botanists there was little effort to study and describe the farm varieties of wheat. However, Heuzé, Körnicke and Werner, Eriksson, Richardson, and others described many varieties, and some of their descriptions were fairly complete. No attempt had been made, however, to show by detailed keys and by uniform descriptions the minor differences that separate closely related varieties.

There has been wide diversity among botanists in the taxonomic use of the various morphological characters of the wheat plant and seed. Only a few authors have given attention to the winter or spring habit of growth in wheat varieties. Some, as Eriksson, have placed undue importance on differences in spike density.

The classification of Körnicke and Werner (*126*) is the most extensive of the earlier studies and the first one that made a definite attempt to describe and classify foreign and domestic farm varieties. Although conservative as to the extent of reduction of the number of species, these authors still maintained a complete Latin nomenclature for forms as far as the fifth rank. They, as well as other early investigators, were handicapped by making their studies in only one locality. In the present work, the varietal descriptions are based on the expression of each variety under widely varying conditions of environment in the United States. The recent work of Flaksberger and his associates (*80*) is an outstanding contribution to the classification of species and varieties of wheat throughout the world.

PRESENT INVESTIGATIONS

The present investigations were started in 1915 [4] with the object of making a classification of the wheats of the world. During the first 2 years much time was devoted to a study of foreign varieties, and several hundred introductions were added to the large collection of foreign wheats previously obtained. In the third year the study was devoted largely to diverse botanical types obtained from hybrids or distinct types found as mixtures in wheatfields in the western part of the United States. It was soon found, however, that if the studies were to be of economic value they must be limited to the principal cultivated varieties. All available domestic varieties were first grown in classification nurseries, where they were studied, described, and classified, and herbarium specimens were prepared and preserved in a classified order. New varieties were added from time to time as soon as they became known, and each year varieties studied during the

[4] The plan to classify wheat varieties was evolved by Carleton R. Ball, then agronomist in charge of western wheat investigations, Office of Cereal Investigations, Bureau of Plant Industry.

preceding season, together with the new ones, were grown to allow comparisons. By this means the classification became more complete each year.

Clark, Martin, and Ball in 1922 (*48*) presented descriptions, histories, distributions, and synonyms of 230 varieties grown up to 1919. Clark and Bayles in 1935 (*43*) included 77 new varieties and omitted 68 of the 230 varieties no longer grown commercially in the United States, thus making a total of 239 varieties. A second revision in 1942 (*44*) included 50 new varieties and omitted 74 (*43*). Thus, a total of 215 varieties were discussed. The present revision includes 81 new varieties, and 72 of the varieties discussed in 1942 are omitted (*44*). Thus, a total of 224 varieties are discussed in this bulletin.

Classification Nurseries

The classification nurseries were grown in widely separated areas of the United States. This was necessary in order to determine the development of varietal differences under many environments and thus provide a classification that would be usable wherever the varieties happened to be grown. It also served to guard against the loss of certain varieties.

During the years 1915–50, some 40,000 separate sowings were made at experiment stations in all parts of the United States. Nurseries grown from 1946 to 1950, preparatory to the revision of Technical Bulletin 795 (*44*), were sown at the Pendleton Branch Experiment Station, Pendleton, Oreg.; Washington Agricultural Experiment Station, Pullman, Wash.; Nebraska Agricultural Experiment Station, Lincoln, Nebr.; New York Agricultural Experiment Station, Ithaca, N. Y.; and Montana Agricultural Experiment Station, Bozeman, Mont. Plant characters and colors develop more distinctly at many points in the Western States, because summer rains are rare and growing conditions favorable. The nurseries were sown in short rows, usually not exceeding 5 feet in length and a foot or 18 inches apart (fig. 1). At the stations where all varieties were grown from both fall and spring sowing, each variety was seeded in the spring on one end of the row sown in the fall.

Assistance Received

The first important task was to obtain samples of the different wheat varieties. This was accomplished with the assistance of many individuals and institutions.

The classification nurseries at the various stations usually were sown by local representatives. They also took notes on emergence, heading, ripening, and height of the many varieties. During the summer the writers visited the various points and took additional notes on the characters of the varieties. The descriptions of the varieties were written largely in the field, and from these descriptions keys were designed to distinguish the different varieties. The descriptions were checked and rechecked at the various points, and the different descriptive classes were established on a basis that is believed to be broad enough to include the varieties wherever grown.

Nature of the Material

The early studies showed the necessity of working with pure types. When bulk seed was used it often consisted of mixed varieties, and a wrong description might easily become applied to a variety. The same variety was often represented by different lots of seed

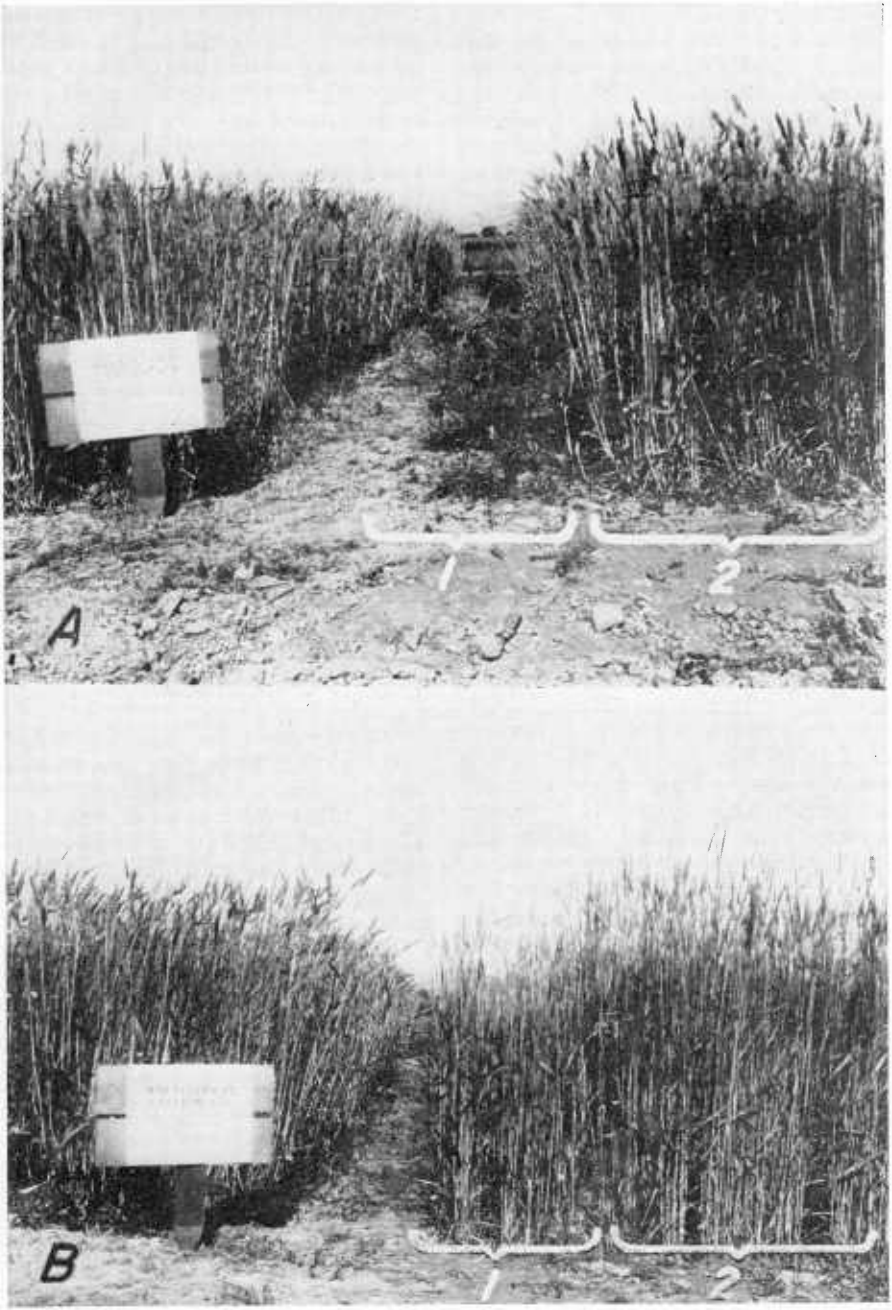

FIGURE 1.—Wheat-classification nursery: *A*, Varieties of winter wheat grown from (1) spring and (2) fall sowing; *B*, varieties of spring wheat grown from (1) spring and (2) fall seeding.

obtained from different sources. These lots were identified by different C. I. numbers, which are accession numbers of the Division of Cereal Crops and Diseases. The varieties, however, have always been known by names rather than by numbers. The records also show the source of the seed and the original source of the variety. After different seed lots of the same variety were grown for a few years, one was selected as the standard for the variety. The descriptions here recorded, therefore, should represent the true type of the variety. In certain cases, however, material was limited to samples obtained from only one or two sources; in these cases, the judgment of the writers in selecting the strain to represent the variety may not be so accurate as in instances where more samples of the same variety were available.

Some varieties here described are badly mixed in commercial fields wherever they are grown. Mention of this sometimes is made in the descriptions. This may account for differences observed between a variety as commonly grown and its description as here recorded. In other cases, all the characters here recorded may not become apparent in some localities, and this may cause some confusion. The failure of stem and glume colors to develop in some sections is an example of this.

Natural crossing between wheat plants occurs quite commonly in some sections of the United States. This natural crossing has caused some difficulty in describing varieties, especially since hybridization between closely related varieties could not always be detected.

Several hundred mixtures obtained from experimental plots and commercial fields were grown in the classification nurseries for identification. A few proved to be mechanical mixtures of varieties grown in the locality, but most of these were new types. These probably originated, for the most part, from natural hybrids, with possibly an occasional mutation. Many of the types continued to segregate, thus proving their hybrid origin. Many of them closely resembled commercial varieties but were not identical in all characters.

Nearly every field of wheat contains some plants that cannot be identified. Many of these, in all probability, are the result of natural hybrids.

Description, History, and Distribution

For each variety this bulletin gives the description, the history so far as known, the distribution in the United States, and the synonymy.

DESCRIPTION

The detailed descriptions, which include the more important taxonomic characters, contain much more information than do the keys. The descriptions are intended to be sufficiently inclusive to provide a comprehensive knowledge of the different varieties.

Following the description of many varieties is a paragraph showing the chief characters that distinguish the variety from closely related ones. Mention is also made of known resistance to diseases and of high- or low-baking properties or other qualities.

HISTORY

The history of the origin of varieties cannot be neglected in a classification, as many varieties are scarcely or not at all distinguishable, by observable characters, from similar or closely related varieties and differ only in their origin and

other qualities. In this study much attention has been given to the history of varieties, and to many readers it probably will be the most interesting and valuable part of the classification. The compiling of these histories has required a review of the literature on wheat varieties written during a period of more than 200 years. The sources of this information are varied. Introductions of foreign varieties have been recorded by the Division of Plant Exploration and Introduction, Bureau of Plant Industry, Soils, and Agricultural Engineering. Frequent reference is made to the accession numbers and published inventories of that Division. Many bulletins of the State agricultural experiment stations contain valuable information on the origin of domestic varieties. Agricultural papers have been reviewed, and much information as to the origin of varieties has been obtained from that source. There is still much to learn concerning the origin of cultivated varieties. The origin of many probably has never been recorded; but for others, though their origin has not been determined, there is probably a recorded history somewhere. The origin and history of the varieties that have appeared in recent years are much more complete than for the older varieties.

DISTRIBUTION

The commercial distribution, production, and grain quality of different varieties are the economic factors with which this classification is concerned. Those varieties that are most widely grown usually are the most valuable. Varieties that are more productive may be in existence, but until they become known and widely grown they are of little value. New varieties are being produced continually. Some are of little or no value. Others are an improvement over the old standard varieties, as their use improves the quality or increases the efficiency of production.

To determine the acreage and distribution of the commercial varieties of wheat in the United States, surveys have been made at 5-year intervals since 1919 in cooperation with the Bureau of Agricultural Economics. The methods of conducting the surveys and the results have been published (*45*, *48*, *49*, *52–55*). By means of these surveys a record of the increase of new varieties and the decrease of old varieties is made possible.

In 1919, 1924, 1929, 1934, 1939, 1944, and 1949, respectively, 139, 152, 190, 213, 208, 216, and 199 distinct varieties were reported. In the 7 surveys 353 distinct varieties were reported.

Maps are included to show the acreage distribution of the more important varieties, the county acreage having been used as a basis. The scale used on the varietal maps is 1 dot for 1,000 acres. A dot is shown in each county from which a variety was reported, even though less than 500 acres were grown in the county.

VARIETAL NOMENCLATURE

A standardized nomenclature is important because names are used by agronomic workers, growers, seedsmen, and the grain trade. The form and appropriateness of these names, therefore, are of general interest. It is desirable that they be short, simple, and appropriate, easily spelled, and easily pronounced. It also is desirable that a single name be accepted and used for each recognized variety.

The multiplication of names and other designations for crop varieties has sometimes been carried to extremes, resulting in great confusion. Some varietal designations

are merely descriptive phrases that are often long and cumbersome. Others are only numbers, which sometimes are equally long and cumbersome or are easily confused. Because of this condition, a code of nomenclature was proposed by Ball and Clark (*18*) and presented to the American Society of Agronomy at its annual business meeting on November 13, 1917. With a few minor changes, the code was adopted. It was also published in Department Bulletin 1074 and Technical Bulletin 459.

Since the adoption of this code simple names have been given to most of the new American varieties. Examples are Brevor, Cadet, Ceres, Forward, Mida, Nebred, Pawnee, Reward, Ridit, Thatcher, and Vigo.

REGISTERED VARIETIES

Through a cooperative agreement between the Bureau of Plant Industry, Soils, and Agricultural Engineering, and the American Society of Agronomy, the 230 varieties described in Department Bulletin 1074 (*48*) were registered (*46*) as standard varieties. Thirty-five additional varieties mentioned in Technical Bulletin 459 have also been registered as standard varieties (*42*). Eighty varieties that originated through introduction, selection, or hybridization have been registered as improved varieties (*41, 47, 51*).

SYNONYMY

Many varieties are known by several names. The names here used for the recognized varieties are the original names or the names now most commonly used or are the new or simplified names, as provided for by the code of nomenclature. All other names used for the varieties here described are considered synonyms.

THE WHEAT PLANT

The different cultivated varieties of wheat vary greatly in their habit, form, and structure, but all are annual grasses. The principal parts are the roots, culms, leaves, and spikes. There are two sets of roots—the first, or seminal or seed, roots, and the second, or coronal, roots which arise from the crown of the stem. The culm usually is a hollow, jointed cylinder comprising three to six nodes and internodes. The upper internode of the culm, which bears the spike, is called the peduncle. The leaves are composed of the sheath, blade, ligule, and auricle. The spike is made up of the rachis and spikelets, the latter in turn comprising the rachillas, glumes, lemmas, paleas, and the sexual organs (the three stamens and the single ovary with its style and stigma). Each of these parts may show distinct characters in different varieties. Those characters that do not vary in different varieties or are not readily observed are of little value in classification. The root characters, for example, cannot be conveniently used, and no attention has been given to them in this work. Other characters, such as those of the sheaths, ligules, and auricles, are not generally used because they show very slight differences in different varieties.

The keys and descriptions used here to identify varieties are based on characters that show constant differences and are therefore of value in identifying them.

TAXONOMIC CHARACTERS

Taxonomic characters of the wheat plant as have been found in the present study to be most useful are described in detail. The characters used to distinguish the different species, subspecies, and lesser groups in the genus *Triticum* are often of no higher rank than the

characters used to distinguish the cultivated varieties.

Because different strains, particularly of the older varieties, may differ slightly in some characters, the C. I.[5] number of the particular strain described is given in the history of each variety.

In the preparation of the keys certain primary characters have been used in a regular sequence. Certain other characters are used to separate further the closely related varieties. For this purpose any character is used that serves to distinguish the varieties under discussion. The same characters are not necessarily used in two successive cases, and they are not used in any definite order. The general principle followed in the choice of characters was to progress from those most easily observed and most often occurring to those least easily observed or least often occurring. The principle governing the sequence of characters is to progress from the absence of the character, as awnlessness, to the presence of the character, and from the smaller size to the greater.

The descriptions of the wheat varieties are arranged in a logical order of plant development. The major and minor characters used in the key are included in their proper places in the descriptions, as are many minor characters not used in the keys.

All the characters used in the keys and the descriptions of cultivated varieties are considered in the following paragraphs in the order of their appearance in the descriptions.

PLANT CHARACTERS

Certain plant characters that are genetically different in the several varieties are of value for classification purposes. These are the habit of growth, the period of growth, and the height of the plant.

HABIT OF GROWTH

All wheat varieties are here classified as having winter habit, intermediate habit, or spring habit of growth. In the keys to the cultivated varieties this character occupies the seventh and last major position.

Varro (in Columella, *62*), writing before the beginning of the Christian era, called the spring wheats *trimestrian*, because they matured in 3 months from sowing. Linnaeus (*134*) treated them as separate species in his Species Plantarum, but combined the awned factor with the spring habit in his species *aestivum* and the winter habit with the awnless factor in his species *hybernum*. Few agronomic writers have recognized these forms as distinct species. The existence of winter and spring forms has been recognized by most authors but recently has not been used as a character for separating species or even as an important character for separating varieties. When considering the United States as a whole, the writers regard these distinctions as less valuable for classification purposes than several spike and kernel characters, although the winter- or spring-growth habit is a very important separation in some areas. In the southern part of the United States, both east and west, several varieties of spring wheat are fall-sown, and growers do not know whether they have a spring wheat or a fall wheat. The Purplestraw variety of the Southeastern States has a spring intermediate habit, although it has been grown from fall sowing in that section for more than 150 years. Nearly all the varieties grown in Arizona and

[5] C. I. refers to accession number of the Division of Cereal Crops and Diseases.

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California are spring wheats, but they are fall-sown.

Winter, intermediate, and spring habits of growth are inherited characters. They are the characters shown first in the descriptions, as they are first apparent in the growth of the plant. In the keys the wheats having a winter habit are listed before those having a spring habit, because there are more fall wheats than spring wheats and because fall wheat is of much greater importance in this country than spring wheat.

The intermediate types retain a prostrate habit of growth in most localities when sown late in the spring, but will head normally when sown early. Some early winter-wheat varieties also have a short prostrate or dormant period and, when early spring-sown, begin heading soon after intermediate wheats have headed. There are also certain varieties of wheat grown commercially that are mixtures with respect to growth habit. The different classes for growth habit are not clear-cut, as there is a more or less complete series of types from true winter to spring and their expression depends upon temperature, length of day, and date of seeding. However, for the varieties reported in this bulletin the differences have been carefully determined by sowing varieties on one or more dates in the spring and observing their behavior. Varieties classified as winter wheats do not produce seed when sown at normal dates for spring seeding. Winter wheats can be produced successfully in the principal wheat areas of this country only from fall sowing. When spring-sown they usually remain prostrate on the ground throughout the growing season and produce no culms or spikes. In some sections or in some years, winter-wheat varieties, sown very early in the spring, will head and produce seed, but heading in such cases is often irregular and usually occurs very late in the season.

All varieties of wheat classified as spring wheats can be grown successfully from fall sowing only in mild climates, such as the southern parts of the United States and in the Pacific Coast States. In parts of this territory they sometimes winterkill. When spring-sown their early growth usually is erect.

TIME OF HEADING AND RIPENING

The relative dates on which varieties head and ripen when sown at the normal time in regions where they are adapted are useful in identifying varieties. The heading date ordinarily is more useful than the ripening date. The relative order of maturity is indicated by classing varieties as early, midseason, or late. The relative time of heading and ripening is somewhat dependent on time of seeding and also varies somewhat in different areas. More than usual caution, therefore, must be exercised in making use of these characters.

HEIGHT

The height of the plant also is often an important factor in wheat production, because it may determine the method or ease of harvesting and the susceptibility of varieties to lodging. Height is measured from the surface of the ground to the tip of the spike, not including the awns of awned varieties. All varieties of wheat have been placed in three classes—short, midtall, and tall. These are characters of minor value for classification and are used only for separating or distinguishing otherwise closely related varieties.

Since plant height influences susceptibility to lodging, several new varieties bred for resistance to lodging have short stems. Although there was formerly a widely

held opinion that tall plants were essential for the production of high yields in wheat, varieties with short stiff straw have been developed recently in several sections of the country that outyield the taller varieties. The principles governing the grouping of varieties as early, midseason, and late apply here also. As an example, under California conditions wheats from 12 to 36 inches in height would be classed as short, wheats from 24 to 48 inches in height would be called midtall, and wheats from 36 to 60 inches high would be considered tall. In many sections of the country these differences would not be so great. In order to use the height of the plant for classification, the height of certain varieties must be determined and used for comparison. There are also cases where the relative height is changed when the varieties are grown in different sections of the country; for example, some of the club wheats are usually short when grown east of the Rocky Mountains but relatively tall when grown west of these mountains.

STEM CHARACTERS

Three characters of the stem of wheat varieties are useful in classification; namely, color, strength, and degree of hollowness.

COLOR

All varieties of wheat are here classified as having white or purple stems. These characters are of minor importance in classification, for in many localities and in some seasons the purple color common to a large number of wheat varieties does not become apparent. This is often the case under conditions of extreme drought and also under conditions of excessive moisture. Under favorable conditions, however, this stem color may be clearly seen for a week or 10 days prior to maturity. When apparent, the color differences are very useful in distinguishing varieties. The color is usually most distinct on the peduncle, or uppermost internode supporting the spikes, but often continues downward to the sheaths of the lower leaves.

Those varieties here described as having white stems may have a stem color ranging from a cream to a golden yellow. Few, if any, have stems that are truly white.

The varieties classed as having purple stems may have a stem ranging in color from a pale violet to a dark purple. In some varieties this coloring may occur only in a short portion of the peduncle. It sometimes does not occur in the peduncle and is present only in the sheaths. Körnicke and Werner (*126*) used color differences in describing many of the varieties with which they worked. Heuzé (*100*) pointed out two contrasting characters, which he called "white" and "reddish."

STRENGTH

The strength of the stem usually is an important character. In many localities lodging is one of the most serious problems in wheat production, as many varieties lodge under conditions of excessive moisture. All varieties here discussed are classified into three groups, having weak, midstrong, or strong stems, respectively. Stems classed as weak are also usually slender, with very thin walls. Varieties with such stems have a greater tendency to lodge, which in turn causes harvest losses and increases the cost of harvesting. The successful cultivation of weak-stemmed varieties usually is limited to semiarid or arid regions.

The varieties classed as having

midstrong stems usually will not lodge under conditions where wheat is grown extensively. In this class are included the greatest number of varieties. A considerable variation exists within this group, and in humid or irrigated sections varieties here described as having midstrong stems might more properly be classed as weak. In dry-farming sections certain of these stems might more properly be classed as strong.

The varieties here described as having strong stems are those that will not lodge readily under excessively humid conditions. Only by severe rain, by hail, or by windstorm can the stems of these varieties be bent or broken down. Comparatively few of the cultivated wheats come in this class.

HOLLOWNESS

The stems of most varieties of wheat are solid at the nodes, but the internodes are hollow. Some varieties of durum and poulard wheat and a very few of common wheat have stems that are solid or nearly so in the internodes. It has been found that in some cases hollowness is associated with resistance to the wheat stem sawfly.

LEAF CHARACTERS

The principal parts of the leaves of wheat plants are the sheath, blade, ligule, and auricle. None of these parts usually show differences that are of even minor value for distinguishing cultivated varieties.

The blades of wheat varieties vary considerably in their dimensions, in the shade of green color, and in the angle to the culm maintained during the successive periods of growth. These differences, however, are usually apparent during only a short period. As the plant matures, the blades dry and frequently break off. In this bulletin very little use is made of leaf characters. A few varieties are noted as having especially broad or narrow blades. The presence or absence of pubescence on the leaves is a useful character in identifying plants of some varieties.

Körnicke and Werner (*126*) and others have described the color of the blades of both the seedlings and the partly grown plants. This also was attempted in the present studies, but the differences were found to be so slight and undependable that no definite classes could be established by using the character. Few persons can agree as to the various shades of green shown by the blades of wheat, even when a standard color chart is used. The color varies with the condition of the plant as affected by the temperature, the soil moisture, and the soil solution. The appearance of the color is changed by the character of the venation and of the blade surface. The plants appear to have a different color in the sunlight from that in the shade, and the value changes also according to the position of the observer with regard to the direction of the rays of the sun. In general, the hard red winter wheats have dark-green blades, whereas all durum varieties have blades with a light-green color.

The blade widths are mentioned in describing only a few varieties, because nearly all varieties are very much alike in this character. The hard red winter wheats are distinctly narrowleaved, and the soft varieties, like Sol and Red Russian, have wide leaf blades. Winter varieties having the narrowest blades usually are most resistant to low temperatures. The length of the blade has not shown sufficiently constant differences for taxonomic purposes.

The terminal leaf or flag leaf of

some varieties of wheat is erect and in others it is drooping at various angles. These differences are greatest just previous to the heading period but frequently are not apparent a few days later. Chiefly because of the instability of this character, it is not used in this classification. In some varieties like Hard Federation and White Federation the flag leaf is curled or twisted, whereas in most varieties it is flat.

The sheaths normally enclose about the lower two-thirds of the culm, although in dry seasons the spike sometimes is not entirely exserted. The edges of the sheath overlap on the side opposite the blade. The sheaths may be either white or purple. During early growth they usually are quite scabrous, but they become smoother at maturity. There are some differences in these characters in the cultivated varieties, but they are few and minute. After a careful study the writers decided not to include any sheath characters in the descriptions.

The same decision was reached in regard to the minute differences observed in the ligules and auricles. The ligules usually are short, varying from 1 to 2 mm. long and becoming lacerate as the plant matures. Auricles always are present on wheat leaves. They are narrow to midwide, usually strongly curved, with a few long strigose hairs on the outer margin. The auricles often are purple in the young stage, sometimes changing to white as the plant matures.

SPIKE CHARACTERS

The entire inflorescence on one culm is called the spike. It is made up of separate groups of flowers known as "spikelets." These are borne singly on alternate sides of a zigzag, flattened, channeled, jointed rachis, parallel to its flat surface. At the base of each spikelet, on the apex of each rachis joint, a tuft of short hairs usually occurs. These hairs may be white or brown in color, but the differences are difficult to distinguish, partly because the hairs frequently are discolored.

Spikes differ greatly in form and degree of compactness. Club wheats (*Triticum compactum*) have been separated from common wheats (*T. vulgare*) principally because of their distinctly compact or dense spikes.

In distinguishing the cultivated varieties, five spike characters are used. These are awnedness, shape, density, position, and shattering of the spikes.

AWNEDNESS

Awns are sometimes of importance agriculturally and are usually the character most readily apparent. For these reasons awnedness is given precedence over all others in preparing the keys. Some earlier writers, as previously stated, used this character for separating so-called species.

Varieties are separated into two major groups on the basis of the awnedness character, namely, awnless to awnleted, and awned. As a minor character in the key and in the descriptions the awnless to awnleted group is subdivided into awnless, apically awnleted, and awnleted. The awn types are shown in figure 2, *A*. Awnless varieties have no awnlets or very short apical awnlets. Apically awnleted varieties have short awnlets 1 to 15 mm. long at the apex of the spike. Awnleted varieties have awnlets 3 to 40 mm. long, the shorter ones occurring near the base of the spike and the length increasing toward the apex. The length of the awnlets and their relative number is given.

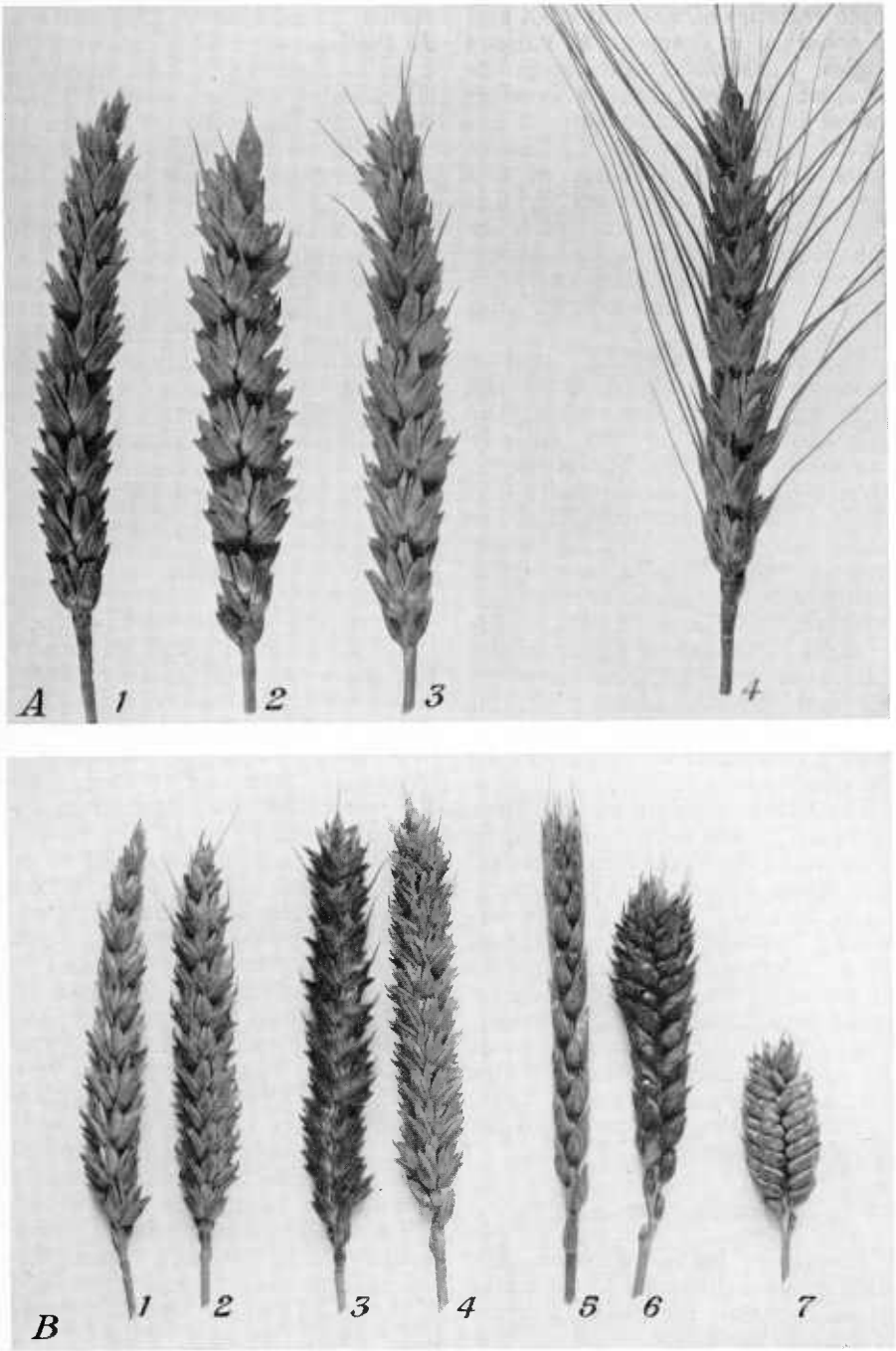

FIGURE 2.—Wheat varieties: *A*, Awn types—(1) Supreme, (2) Onas, (3) Thatcher, and (4) Ceres; *B*, spike shapes—(1 and 2) fusiform, (3 and 4) oblong, (5 and 6) clavate, and (7) elliptical.

Awned varieties are those that have an awn or beard that terminates the lemmas on all spikelets. These awns usually increase in length from the basal part of the spike upward. In the common wheats, awns seldom, if ever, exceed 10 cm. in length. In durum and poulard wheats, however, they usually range from 10 to 20 cm.

SHAPE

Spikes differ greatly in shape, length, and width. They may be flattened parallel or at right angles to the plane of the face of the spikelets. Those flattened parallel to this plane are widest when seen in face view and can be said to be dorsoventrally compressed. The spikes of all varieties of common wheat are thus formed, except those that are clubbed at the tip, in which case they are only partly so. Spikes that are flattened at right angles to the plane of the face of the spikelets are narrow when seen in face view and may be described as laterally compressed. The club, durum, and poulard wheats are separated from the common wheats partly on the basis of having such spikes.

In general, spikes vary in length from 5 to 15 cm., but are usually 8 to 12 cm. long. They vary in width or thickness from 1 to 3 cm. The differences in length and width are not used in themselves, but are often combined with the spike shape in a compound descriptive word.

Whether dorsoventrally or laterally compressed, whether long or short, or narrow or wide, spikes are classified in the keys as having the following four general shapes—fusiform, oblong, clavate, and elliptical. These shapes are shown in figure 2, *B*. For all common wheats these shapes are determined from a face view of the spikelets and for all club, durum, and poulard wheats from an edge view of the spikelets.

Heuzé (*100*) used several different spike shapes as the leading characters in separating varieties within the species. The shapes mentioned, however, are here considered only as minor characters; nevertheless, they are very useful in distinguishing varieties.

Spikes classed as fusiform taper toward the apex or from the middle toward both base and apex. A majority of the varieties of common wheat have spikes of this shape.

Spikes described as oblong are usually uniform in width and thickness throughout the length of the spike but are always several times longer than wide.

Varieties classed as having clavate spikes are clubbed, that is, distinctly larger and more dense at the apex. This is caused by a shortening of the rachis internodes in that part of the spike, which results in a change from dorsoventral to lateral flattening and a broadening of the upper part of the spike.

Elliptical spikes are short and uniformly rounded at both the base and apex but are flattened on the sides. Most varieties of club wheat have spikes of this shape.

In the descriptions of varieties these designations of spike shapes have sometimes been modified to take into account the length and width of the spikes and the overlapping of shapes that occurs in some varieties.

Spikes that are usually long are described as linear fusiform, linear oblong, or linear clavate. If spikes are unusually short, that fact is included in the description. Broad spikes may be described as broadly fusiform, broadly oblong, or broadly clavate; and narrow spikes as narrowly fusiform, narrowly oblong, or narrowly clavate.

Varieties that are nearly intermediate between any of the shapes are sometimes described as oblong fusiform or oblong to subclavate.

By the use of these compound descriptive terms spike shapes are more accurately presented in the description than they can be in the keys, where brevity is imperative.

DENSITY

The differences in shape of spikes shown above are the result in part of differences in density. All spikes are described as of three density classes—lax, middense, and dense. These are minor differences that are used to advantage in distinguishing varieties. Seringe (*187*) separated the common wheats into two groups, having lax and dense spikes, respectively. Körnicke and Werner (*126*) described the spikes of many varieties according to different degrees of density. Neergaard (*146*) suggested a formula for use in measuring the density of the spike. Eriksson (*74*) subdivided the botanical groups of Körnicke and Werner on the basis of density into subvarieties called *laxum*, *densum*, and *capitatum*. He measured the density of spikes by determining the number of spikelets in 100 mm. of rachis length. Heuzé (*100*) used the spike density along with spike shape as the leading character in separating varieties. Boshnakian (*25*) described means of measuring density and suggested the name *Triticum compacto-capitatum* for varieties of club wheat having clavate heads.

Many measurements have been made by the writers to determine the difference in density of the spikes of the varieties here described. The most definite differences were found comparable at 1 station for 1 year, but otherwise these measurements were of little value. It was found necessary to establish density classes of rather indefinite limits. In this way allowance was made for the varying conditions. The density classes were fixed as lax, middense, and dense by determining the number of millimeters occupied by 10 internodes of the rachis measured in the center of the spikes. By this method spikes are classed as lax when 10 internodes occupy from 50 to 75 mm., as middense when 10 internodes occupy from 35 to 60 mm., and as dense when 10 internodes occupy from 20 to 45 mm. A majority of the varieties are included in the middense class, which, according to the above measurements, overlaps both the dense and lax classes by two-fifths of their entire range.

POSITION

The position of the spike at maturity is often distinctly different in different varieties. Spikes are here described as erect, inclined, or nodding. Heuzé (*100*) used essentially these same distinctions in describing his varieties.

Those varieties described as having erect spikes mature with the spike in an approximately vertical position. The spikes of these varieties seldom, if ever, are inclined more than 15° from the vertical at maturity. Spikes of varieties that are described as inclined usually mature at an angle of approximately 15° to 45° from the vertical, but sometimes are nearly erect and under some conditions will become slightly nodding. The majority of wheat varieties come within this class. Varieties that are described as having nodding spikes usually mature with the spike in a drooping position, the apex of the spike being lower than the base. Spikes of such varieties sometimes are only inclined if they are not well filled with grain when ripe.

SHATTERING

Glumes of different varieties vary in the tenacity or firmness of attachment to the rachis, in the

tightness with which they clasp the kernels, and in size in relation to size of the kernels. These and possibly other characters cause varieties to differ greatly in their resistance to shattering. The durum varieties usually do not shatter easily. Most commercial varieties of common and club wheat are resistant, but some varieties are subject to loss of grain by shattering if allowed to stand in the field after they reach maturity. Such varieties are not adapted for harvesting with the combine. This character is usually mentioned only for the varieties that shatter easily.

GLUME CHARACTERS

The unit of the spike is the spikelet. It consists of several flowers or florets attached alternately to opposite sides of a central axis or rachilla. These flowers, two to five in number, are subtended by two empty scales, called the glumes, the keel of each glume terminating in a tooth or beak. Each floret consists of a flowering glume, called the lemma, and a thin two-keeled glume, called the palea. These two glumes enclose the sexual organs. The lemma encloses the back, dorsal, or outer portion of the mature kernel, and in the awned varieties it terminates in an awn. The lemma itself is of little or no use in classification. The palea protects the inner or crease side of the kernel. It differs from the lemma in having its back instead of its face toward the rachilla or axis of the spikelet. Like the lemma, it is not used in distinguishing varieties. The outer glumes, however, are much used.

The covering and coloring of the glumes are major characters of the second and third place, respectively. The length and width of the glumes also are used but are of only minor importance.

COVERING

Glumes of all varieties here discussed are described as glabrous or pubescent (fig. 3). Host (*107, v. 4*)

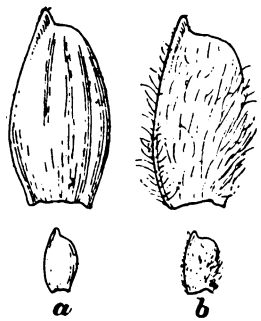

FIGURE 3.—Glume covering: *a*, Glabrous; *b*, pubescent. (× 1 and × 3.)

placed the pubescent-glumed wheats in a separate species called *Triticum villosum*. Several later authors also considered pubescent wheats as different species. This character is used here, however, only as a major one in separating varieties. It is given second place in the keys because of the definite and striking contrast between absence and presence. This is in accordance with the usage of Körnicke and Werner (*126*).

Glumes described as glabrous are without any covering of hairs. Those described as pubescent are more or less covered with hairs of varying length. Pubescence usually is readily apparent. The degree of pubescence varies in the different varieties. On some the hairs are much longer and more numerous than on others. Glumes of some durum varieties are partly glabrous and partly pubescent but are classed as pubescent. In such varieties the pubescence is most often found on the edge of the glumes.

COLOR

Differences in glume color were early recognized. Lamarck (*127*)

used these distinctions in classifying varieties. Glume color is here used as a major character and occupies third position in the key because of the distinct differences that are readily apparent when the plants are mature. This is also in accord with the usage of Körnicke and Werner (*126*). All glumes are classed as white, yellowish, brown, or black.

Glumes classed as white may vary in color from a cream or pale-straw color to a dark yellow. Practically no glumes are without color. Within the class, however, there are two rather distinct shades. Some taxonomists have classified them separately as white and yellowish. In the present bulletin, however, both shades are placed in the same class and described only by the term "white" except in the case of the durums, which are classed separately as white and yellowish. In the descriptions the glumes of some varieties of common wheat are described as being yellowish white, indicating a darker glume than those described as white. A few varieties have white or yellowish glumes with brown or black stripes or nerves, or the glumes are sometimes tinged on the edges with brown or black. Such varieties are placed in the white-glumed class and the peculiar markings are indicated in the descriptions. The Blackhull variety has glumes that usually are tinged with black but sometimes are almost entirely black. The Rudy variety has black stripes along the edges of the glumes.

Glumes of durum varieties classed as yellowish are much darker than those of the common wheats classed as white but similar to those described as yellowish white. This yellowish class, therefore, is quite distinct. It may range in color from yellow to buff.

The brown-glumed class usually is still darker than the yellowish class and may vary in shade from light to dark brown and bluish brown, and in some varieties there is a reddish or mahogany tinge. For the latter reason some taxonomists have used the term "red," but in the present work the writers prefer the term "brown," as it more accurately describes the glume color of the class as a whole.

There are no commercial varieties grown in the United States having glumes that are entirely black.

LENGTH

Glume length is used as a minor character in the varietal descriptions. Usually small-kerneled varieties have short glumes and large-kerneled varieties long glumes, but there are exceptions to this. The glumes are usually about three-fourths the length of the lemmas, although in some long-glumed varieties the glumes and lemmas more nearly approach the same length. Polish wheat (*Triticum polonicum*) has glumes as long as or longer than the lemmas and is separated from the other species principally on this distinction. The length of the glume is here described as short, midlong, or long. These length differences are illustrated in figure 4.

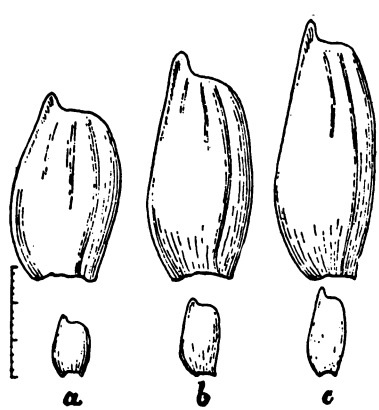

FIGURE 4.—Glume length: *a*, Short; *b*, midlong; *c*, long. (× 1 and × 3.)

Heuzé (*100*) and Scofield (*184*) used essentially these same terms. Most varieties of wheat have midlong glumes. A few varieties, however, are distinct in having either short or long glumes. Short glumes may have lengths varying from 6 to 10 mm. Midlong glumes may vary from 8 to 12 mm. and long glumes from 11 to 15 mm. The glumes of Polish wheat exceed this latter measurement and are described as very long.

WIDTH

The width of glumes is used in the same manner as the length. All glumes are described as being narrow, midwide, or wide (fig. 5).

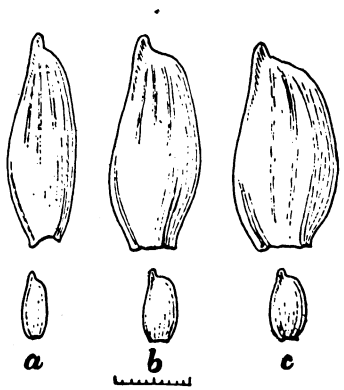

FIGURE 5.—Glume widths: *a*, Narrow; *b*, midwide; *c*, wide. (× 1 and × 3.)

These differences were pointed out by Scofield (*184*). The width of the glume is here determined across its center from the keel to the margin of the outer side. Narrow glumes may vary in width from 2 to 4 mm., midwide ones from 3 to 5 mm., and wide ones from 4 to 6 mm. The differences are small and much overlapping of the classes occurs. Wide glumes nearly cover the lemma at the point of measurement, whereas narrow glumes usually cover less than a third of it.

SHOULDER CHARACTERS

The shoulder as here considered is the more or less rounded end of the glume from the beak to the lateral margin, including the part referred to by Körnicke and Werner (*126*), Hackel (*91*), and others as side teeth. Scofield (*184*) applied the name "shoulder" to this part of the glumes.

Considerable variation exists in shoulder width and shape in different varieties and also in different spikes of the same variety and even among the glumes on a single spike. Although variable, they are of some value in classification.

WIDTH

The shoulder widths often differ from the glume widths. For this reason they are described separately but on the same basis of measurement and by the use of the same terms—narrow, midwide, and wide (fig. 6).

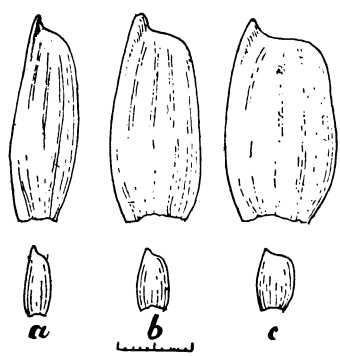

FIGURE 6.—Shoulder widths: *a*, Narrow; *b*, midwide; *c*, wide. (Upper row, × 3; lower row, × 1.)

SHAPE

Shoulder shapes are described in overlapping terms that allow for a considerable variation, which is nearly always present in the same spike. The terms used are wanting, oblique, rounded, square, elevated, and apiculate (fig. 7).

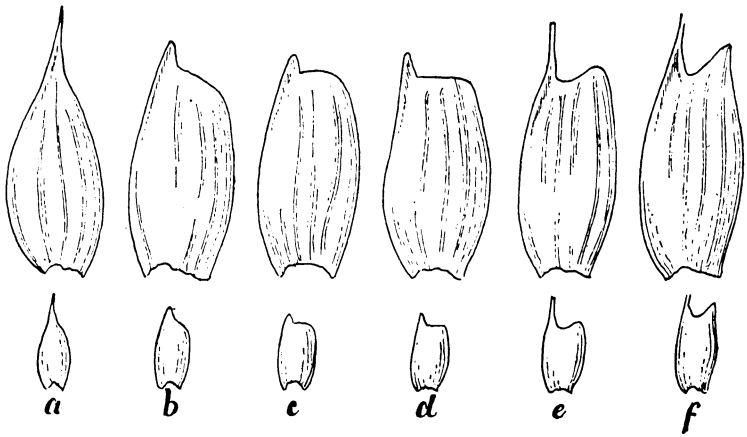

FIGURE 7.—Shoulder shapes: *a*, Wanting; *b*, oblique; *c*, rounded; *d*, square; *e*, elevated; *f*, apiculate. (Upper row, × 3; lower row, × 1.)

BEAK CHARACTERS

The word "beak" is used here for the short projection that terminates the keel of the outer glume. In some varieties it approaches an awn in appearance. Scofield (*184*) first used the term "beak," previous authors having referred to it as a tooth or point. The beaks vary in width, shape, and length. These characters are of considerable importance in identification and are used in the descriptions of the varieties.

WIDTH

Beak widths are described as narrow, midwide, and wide (fig. 8). The average beak is only 1 mm. wide, so the variations are very small, and general observation is the only basis for describing them. Those that are wider than the average are called wide and those that are narrower are called narrow.

SHAPE

The apex of the beak varies considerably in shape. It is described as obtuse, acute, and acuminate (fig. 9). Obtuse beaks are blunt at the apex. Acute beaks come to a point at the apex. Acuminate beaks are narrowly and

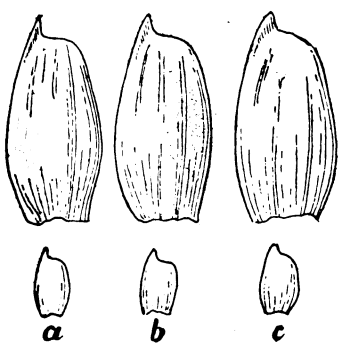

FIGURE 8.—Beak widths: *a*, Narrow; *b*, midwide; *c*, wide. (Upper row, × 3; lower row, × 1.)

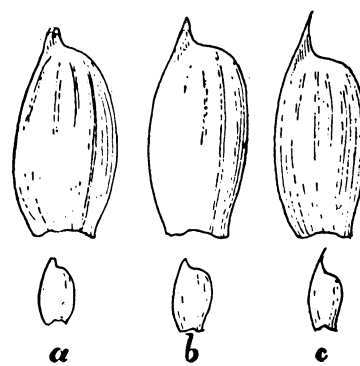

FIGURE 9.—Beak shapes: *a*, Obtuse; *b*, acute; *c*, acuminate. (Upper row, × 3; lower row, × 1.)

very sharply pointed. All awned spikes have acuminate beaks.

LENGTH

Beak lengths are quite variable, especially in the awned varieties, and are considerably influenced by environment. In general, conditions that increase or decrease the length of the beak affect nearly all varieties to a similar degree. In the awnless, apically awnleted, and awnleted wheats the differences in length are not great, but in many varieties they are quite distinct. The length of the beak is measured from the shoulder of the glume upward. On most awned wheats the length increases from the base of the spike to its apex. The range of difference varies greatly with the variety. For this reason no single measurement is used in describing the lengths, but instead the average maximum and minimum lengths are given. None of the awnless varieties here described has beaks longer than 3 mm. Variations in beak lengths are shown in figure 10.

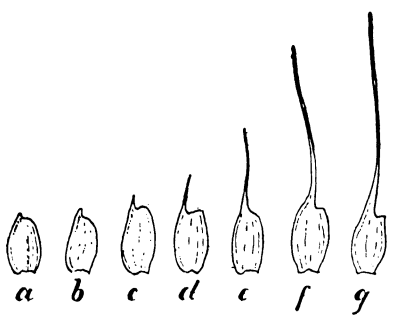

FIGURE 10.—Beak lengths, showing seven variations. (× 1.)

AWN CHARACTERS

Certain characters of the awn are distinct. Some of these are important in classification, although others are not. The divergence of the awn from the vertical is one that is not important. The awns of some varieties are all nearly vertical or appressed, whereas others are spreading. These characters are affected by drought or other abnormal conditions and usually are not sufficiently constant for classification purposes. The awns of some varieties sometimes are deciduous, dropping off at maturity. This occurs so rarely that it is of little or no use in classification. The color and length of the awns, however, are factors of some importance in this classification.

COLOR

In the key to the varieties of durum wheat the awn color is used as the fourth major character. This method was followed by Körnicke and Werner (*126*). For the other species and subspecies the awn color is used only as a minor character. All awns are described as white or black. The white class may include yellowish shades, and the black class may include shades of brown and blue. Few varieties of common wheat have really black awns.

LENGTH

The length of the awn in awned varieties is of slight value in classification. No attempt has been made in these studies to separate these varieties into classes with respect to awn length. In all descriptions, however, the average extreme lengths are recorded in centimeters.

KERNEL CHARACTERS

The kernel color, length, and texture are the most constant of all the kernel characters. These are used as major distinctions. The shape of the kernel is considered of only minor importance, as are certain differences of the germ, crease, cheeks, and brush.

COLOR

Kernel colors were early recognized as important characters in

separating varieties. Most varieties were observed to have either white or red kernels but were sometimes regarded as being yellow or brown. The kernel color was used by Körnicke and Werner (*126*) and by Vilmorin (*215*) as one of the leading taxonomic characters of wheat. Heuzé (*100*) and Körnicke and Werner have indicated various shades of white or yellow and of red in the descriptions of the kernel color. Eriksson (*74*) believed that white wheat becomes red and states that the color of grain is useless in distinguishing a variety. Cobb (*57*) arranged the wheats he was growing according to the color tint from lightest to darkest. Howard and Howard (*109, p. 228*) regard the wheat kernel as being either white or red. They state that "the particular tone of colour depends partly on the consistency of the grain." Hayes, Bailey, Arny, and Olson (*96*) proposed the use of the terms "red" and "white" in describing the presence and absence of a brownish-red pigment in the bran layer. The use of the modification "light red" was suggested where the degree of pigmentation was less than usual in the red wheats. Three varieties of Abyssinian wheat having violet-colored kernels were mentioned by Körnicke and Werner (*126*). The writers have grown purple-kerneled wheats from Ethiopia (Abyssinia), but they are not considered in the present classification.

Kernels of all varieties are grouped into two classes, described as white and red, and, as in the glume colors, many different shades are present. In general, however, the two classes distinctly separate all wheats.

Kernels of the white class may vary from cream to yellowish, or they may be white, without pigment. White or faintly pigmented kernels may appear to have different shades of yellow color because of differences in texture of the endosperm.

Kernels of the red class may vary from light brown to the darker shades of red. The variations are due to varietal differences and environment. Differences in texture, due to varying conditions, may cause "yellow berries," which sometimes give the kernels a mottled appearance. Some samples have been received for identification in which kernels appeared to be partly red and partly white. This condition has been found to be the result of environment, as such kernels produce plants with only red kernels.

Many writers have classed some varieties as "amber." This usually refers to a white kernel having a translucent or vitreous endosperm. The term "amber" is used to designate a certain subclass of durum wheat in the United States official grain standards. Until recent years hard red kernels sometimes were referred to as amber-colored. The word "amber" also has been used as a part of a varietal name, such as Martin Amber, which is a soft white wheat, and Michigan Amber, which is a soft red wheat. Because of this ambiguity and because wheats usually are either red or white, the word "amber" is not used in this bulletin in describing wheat kernels.

LENGTH

The length of the kernel is used as a major character in distinguishing varieties.

Körnicke and Werner (*126*), in their descriptions of wheat varieties, indicated the average length and width of the kernels in millimeters and the average number of kernels in 10 grams. The kernels were described as very small, small,

large, and long. Heuzé (*100*) described the kernels as short, medium, or long. The size of the kernels of any variety varies when grown in different sections or in different years in the same section. From necessity, therefore, the limits of the classes in which varieties are placed must be overlapping. A kernel of wheat reaches its maximum length several days before ripening. The length, therefore, is fairly constant, even when it is considerably shrunken, and is the most valuable of the kernel dimensions for taxonomic purposes. In making measurements only the normal kernels should be used. The kernels from the tip spikelets on a spike and from the upper florets in the spikelet are below average length.

In the keys two classes are made, namely, kernels short to midlong and kernels midlong to long. In the descriptions three classes—short, midlong, and long—sometimes are mentioned separately. These kernel lengths are shown in figure 11.

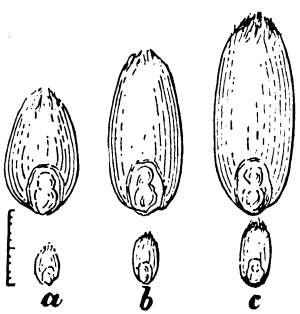

FIGURE 11.—Kernel lengths: *a*, Short; *b*, midlong; *c*, long. (Upper row, × 3; lower row, × 1.)

The short to midlong class includes varieties the kernels of which measure within the limits of 4 to 7.5 mm. in length. The midlong to long class includes varieties the kernels of which come within the limits of 6.5 to 10 mm. For individual samples more definite limitation is possible. For this purpose the term "short" is used for kernels ranging from 4 to 6 mm. in length, "midlong" for those ranging from 6 to 8 mm., and "long" for those ranging from 8 to 10 mm.

TEXTURE

The texture of wheat kernels is an important character in classification. It has an economic value, as most wheat is marketed in commercial classes, which are fixed largely on a basis of texture because hard wheats generally are better for bread making than soft wheats.

Two texture classes are used—kernels soft to semihard and kernels semihard to hard. Here, as with size, overlapping class limits were found necessary. In general, all wheat varieties can be classed readily in one or the other of these two groupings. In describing specific samples and in individual description of varieties, three classes are used separately, as soft, semihard, and hard. A soft kernel is one that, when normally developed, has an endosperm entirely soft, mealy, or starchy. A hard kernel, when normally developed, has a corneous, horny, or vitreous endosperm throughout. A semihard kernel has an endosperm that is intermediate between the other two.

The species *Triticum durum* was so named by Desfontaines (*67*) because of the hardness of the kernels. Metzger (*142*) divided the white-kerneled wheats into two groups on the basis of texture, the starchy ones being considered as yellow. Körnicke and Werner (*126*) described the kernels of different varieties as being entirely mealy, nearly entirely mealy, mostly mealy, partly mealy, partly glassy, mostly glassy, nearly entirely glassy, and entirely glassy. The texture of the same variety varied in different seasons.

These authors, as well as Eriksson (*74*), Fruwirth (*83*), and Howard and Howard (*109, p. 232*), conclude that kernel texture is useless as a varietal character and that it depends on environment. Hayes, Bailey, Arny, and Olson (*96*) suggest the terms corneous, subcorneous, substarchy, and starchy for describing the texture of the wheat kernel. The writers have concluded that because of the variability in texture under different environments one can separate varieties of wheat accurately into only two classes and fairly accurately into three classes. Soft-kerneled varieties grown under very dry conditions will sometimes become brittle and slightly subcorneous. When hard-kerneled varieties are grown under humid conditions or in soil deficient in nitrogen they sometimes become starchy, semistarchy, or mottled, the condition being designated as "yellow berry," and the kernels are then rather soft.

The difficulty of numerous investigators in determining the kernel texture has been caused by the failure to dissociate softness from starchiness or yellow berry. Freeman (*82, pp. 224–225*) has shown the nature of hardness in the wheat kernel. The following is quoted from his conclusions:

1. The hardness of a wheat is determined by the solidity of the grain, and this, in turn, by the nature and relative proportions of gluten and starch in the endosperm.

2. When the ratio of gluten to starch is sufficiently high, the entire cell contents are cemented together solidly as the grain dries out in ripening. It, therefore, takes on a hard, glassy, semitranslucent texture. In the absence of a sufficient proportion of gluten to hold the cell contents together, the shrinkage in drying does not fully compensate for the loss of water, and air spaces appear within the cells. These open spaces render the grain soft and, also, since they serve as refracting surfaces, make it opaque. We are, therefore, accustomed to associate softness, opaqueness, and low gluten content in wheats.

3. There are two types of soft grains among the wheats included in these experiments.

(a) A type designated by the writer as "true softness" in which the air spaces in the endosperm are diffuse and finely scattered. This type of softness is only slightly affected by environic conditions.

(b) A type commonly called "yellow berry," in which the air spaces within the endosperm occur in flakelike groups with quite definite margins. The opaqueness thus arising may be confined to a small spot only or may include the entire endosperm. This type of softness is very sensitive of environic conditions.

In this bulletin soft texture refers to the condition designated above as "true softness" and must not be confused with yellow berry.

True kernel texture, therefore, cannot be determined on yellow-berry kernels, because they always are soft. It usually is possible, however, to select from a sample a few kernels that are not wholly starchy and that can be accurately used for texture determinations. Roberts (*172*) attempted to measure hardness mechanically by determining the crushing strength. This is not entirely accurate, as the shape of the kernel influences its crushing strength and, in addition, soft-wheat varieties grown under dry-land conditions are quite brittle and difficult to crush. The particle-size determination of Cutler and Brinson (*65*) and the pearling test of Taylor, Bayles, and Fifield (*204*) are useful in determining the texture of kernels of varieties. Texture in the present studies was determined by cutting kernels not affected by yellow berry and examining the endosperm.

SHAPE

The shape of the kernel is described as ovate, elliptical, or oval (fig. 12). These terms refer only to the outline of the kernel as viewed from the dorsal surface, and not to

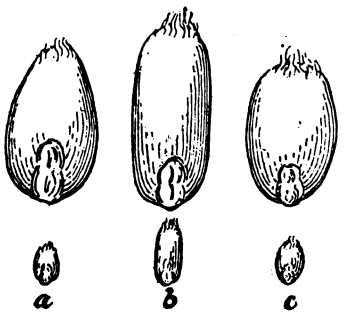

FIGURE 12.—Kernel shapes: *a*, Ovate; *b*, elliptical; *c*, oval. (Upper row, × 3; lower row, × 1.)

the kernel as a whole. When egg-shaped in outline, the germ end being the broader, it is described as ovate. An elliptical kernel is one the length of which is more than twice the width and that has sides somewhat curved and both ends rounded. An oval kernel is broader, like the ovate, but with both ends of nearly equal width. Modifications of these shapes are indicated by describing kernels as narrowly or broadly elliptical, ovate, or oval, as the case may be. A few varieties, as Baart, show other characteristic shapes, which are given in the descriptions of these varieties.

Most kernels are classified as ovate, but in a few varieties a considerable part of the kernels may have one or the other of the shapes just noted. The shape of the wheat kernel is influenced by the position in the spikelet, the position in the spike, and the degree of plumpness. Boshnakian (*26, p. 205*) has shown that spikelet characters that affect the shape of the wheat kernel are mainly—

(1) The stiffness of the glumes, (2) the size and shape of the space in which the grain develops, (3) the number of grains in the spikelet and their position, (4) the density of the head, (5) the pressure caused by the growth of different parts of the head, and (6) the species which produces the kernel.

The kernels from the base or tip spikelets on the spike are shorter in proportion to width than the others. The kernels from club wheat or from the tip spikelets of clavate spikes of common wheats are usually laterally compressed or "pinched." Shrunken kernels usually have an elliptical shape because of being narrow. As the width of a kernel of wheat depends largely upon the degree of development of plumpness, this character has very little taxonomic value.

The tip, or brush, end of nearly all varieties is rounded, but the kernels of a few varieties, in which the tips are square rather than rounded, as seen from the dorsal view, are described as truncate. Kernels of a few varieties have acute or pointed tips, as seen in both dorsal and lateral views, and such tips are described as acute.

The shape of the kernel as seen in the lateral view is important in only a few varieties. Many varieties, especially durums and emmers, are more or less keeled on the dorsal surface. Normally the kernels of wheat, in dorsoventral diameter, are thickest near the base, just above the germ. In a few varieties the kernels are strongly elevated on the dorsal side of this basal portion and they are popularly known as "humped." That term is used in describing such kernels. When the dorsal portion is less keeled than normal the kernel is described as flattened. Where only the tip of the kernel is thus flattened it is described as having a flattened tip. The kernels of a few varieties when viewed from the side have a depressed dorsal surface about midway between the ends. This feature is referred to as sway-backed.

The shape of the kernel has been used as a distinguishing character by only a few authors. Körnicke and Werner (*126*) recorded the lengths and widths of the kernels and referred to some as roundish or elongated. Eriksson (*74*) used the number of kernels in 100 mm., placed side by side, to indicate the width of the kernel. This character is, however, of value only in comparing varieties grown under identical conditions. Heuzé (*100*) described the shape of kernels of each variety, using such terms as elongated, short, angular, compressed, ovoid, oblong, and swollen. Scofield (*184*) suggested 16 descriptive terms to be applied to the shape of wheat kernels. Wheat kernels cannot be accurately described according to shape unless they are normally developed, that is, neither shrunken nor excessively plump.

GERM CHARACTERS

The size and shape of the germ, or embryo, of the wheat kernel have seldom been used as characters in classification. After examining thousands of samples, the writers have concluded that the size of the germ is one of the most constant of minor kernel characters. There is considerable variation among the individual kernels of a bulk sample, but typical kernels of a pure variety have a characteristic size of germ. The germ is developed earlier than the endosperm and consequently is of almost normal size even in shrunken grain.

The germ is here described as small, midsized, or large (fig. 13). A small germ is one that occupies less than one-sixth of the area of the dorsal surface of the kernel or the area visible in dorsal view. A midsize germ occupies from one-sixth to one-fourth of the dorsal area of the kernel. A large germ occupies one-fourth or more of the dorsal area.

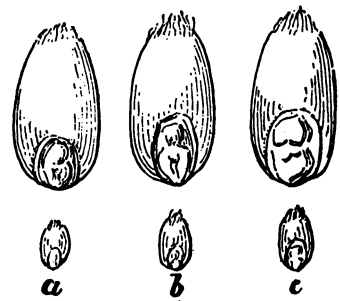

FIGURE 13.—Germ sizes: *a*, Small; *b*, midsized; *c*, large. (Upper row, × 3; lower row, × 1.)

The limits of the three size groups overlap. Most kernels have a midsized germ, so these characters are not much used in distinguishing varieties. For some varieties, however, they can be used to advantage.

CREASE CHARACTERS

The crease, or sulcus, on the ventral side of the wheat kernel is rather variable but is of value in distinguishing a few varieties. The chief taxonomic characters are the width and the depth. Shrunken kernels nearly always have a relatively wide and deep crease, whereas in extremely plump or yellow-berry kernels the crease is narrow and shallow, because the space beneath the bran is occupied by large starch cells and air spaces.

WIDTH

The width of the crease is determined by the distance between the crests of the cheeks on each side of the crease. Creases are described as narrow, midwide, and wide (fig. 14). A narrow crease is about two-thirds or less of the total width of the kernel in ventral view. The midwide crease, which is typical of most varieties, is usually about four-fifths of the total kernel width. A wide crease is almost the total width of the kernel.

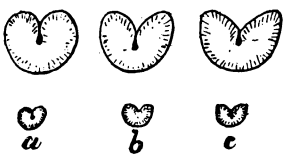

FIGURE 14.—Crease widths: *a*, Narrow; *b*, midwide; *c*, wide. (Upper row, × 3; lower row, × 1.)

DEPTH

The depth of the crease in this classification has been determined by an external examination rather than by a cross section of the kernel. The depth, therefore, is judged from the crest of the cheeks to the position where the crease is closed. No measurements of the portion of the crease below the surface of the kernel have been considered. Crease depths are described as shallow, middeep, and deep (fig. 15).

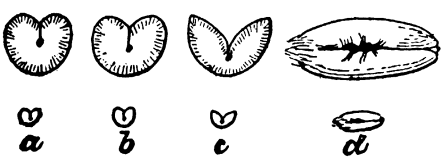

FIGURE 15.—Crease depths: *a*, Shallow; *b*, middeep; *c*, deep; *d*, pitted. (Upper row, × 3; lower row, × 1.)

A shallow crease has a depth of 20 percent or less of the dorsoventral thickness of the kernel. A middeep crease has a depth of from 15 to 35 percent of the thickness of the kernel, and a deep crease has a depth of 30 to 50 percent of the thickness of the kernel.

The depth of the crease is of taxonomic value only when the kernels are normally developed and is a distinguishing character in only a few varieties. It is sufficiently constant, however, to be of use in describing varieties grown under identical and normal conditions. Nearly all of the durum and club wheats have a shallow crease. A few varieties of common wheat have been described as having a "pitted" crease. This is characterized by having a distinct opening near the center of the crease (fig. 15, *d*). The sides of the opening usually are wrinkled. The pitted character is most marked on the kernels of the Humpback (no longer grown commercially) and the Huston varieties.

CHEEK CHARACTERS

The cheeks of a kernel are the ridges along each side of the crease on the ventral surface of the kernel. The most distinguishing character of the cheek is the outline of the crest in cross section. This is rounded or angular (fig. 16). Extremely starchy (yellow berry) kernels always have rounded cheeks, whereas the cheeks of shrunken kernels are always angular. It is necessary, therefore, to examine normally developed kernels in order to recognize the differences. All of the durum wheats have angular cheeks. Most of the common wheats have cheeks that are more or less angular, but a few varieties, such as Turkey, consistently have rounded cheeks. There is no sharp distinction between the angular and the rounded cheeks.

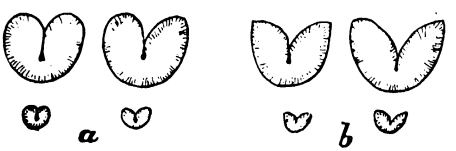

FIGURE 16.—Cheek shapes: *a*, Rounded; *b*, angular. (Upper row, × 3; lower row, × 1.)

BRUSH CHARACTERS

The brush of the kernel is the hair at the tip or the end opposite the germ. Cobb (*59*) described in detail the brush of 51 varieties of wheat grown in Australia.

SIZE

The size of brush refers to the area that it occupies on the kernel. It is described as small, midsized, and large (fig. 17). A small brush

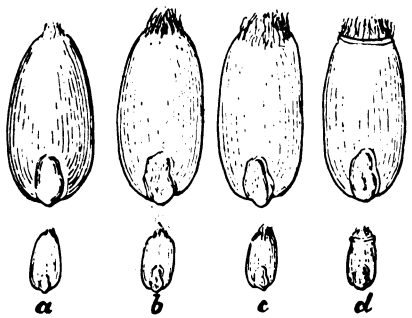

FIGURE 17.—Brush sizes: *a*, Small; *b*, midsized; *c*, large; *d*, collared brush. (Upper row, × 3; lower row, × 1.)

occupies only a part of the tip of the kernel. In kernels that are distinctly pointed at the tip, however, it may cover all of the end. A midsized brush covers the tip of the kernel. Nearly all varieties of wheat come within this class. A large brush is one that extends partly over the sides of the kernel, chiefly along the crease.

LENGTH

The length of brush refers to the average length of hairs, which are described as short, midlong, and long (fig. 18). In short brush the

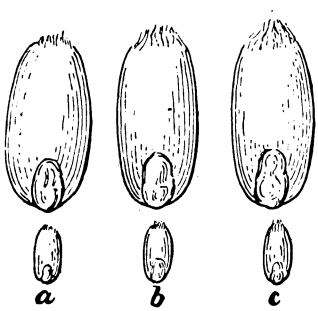

FIGURE 18.—Brush lengths: *a*, Short; *b*, midlong; *c*, long. (Upper row, × 3; lower row, × 1.)

hairs are less than 0.5 mm. long, in midlong brush from 0.5 to 1 mm. long, and in long brush more than 1 mm. long. A few very long hairs may be present in a short brush.

All durum wheats and some varieties of common wheat, such as Red Bobs, have a short brush. Both size and length of brush are very constant characters, probably the most constant kernel characters aside from color and size. In machine threshing, part of the hairs of the brush frequently are removed.

COLLAR

The brush area of some varieties is here described as "collared" (fig. 17, *d*). Cobb (*59*) referred to this as an abrupt margin. This refers to the presence of a distinct raised collar or flange of bran along the margin of the brush area. This is most noticeable on shrunken kernels, but is very distinct on normal kernels of a few varieties, such as Goldcoin.

OTHER CHARACTERS

Several characters of wheat varieties of interest to growers cannot be observed in a morphological examination. These differences often are of great economic importance but are of little value in classification. Following the descriptions of many of the varieties, therefore, other characters of importance, such as productivity, quality, resistance to low temperatures, and resistance to diseases and insects, are mentioned.

PRODUCTIVITY

A comparison of yield of different varieties of wheat is of value only when the varieties are grown under identical conditions, as side by side, on identical soil, and in one locality in the same season. Under certain conditions it is possible for almost

any variety to outyield all others, and consequently an expression of yield is of little taxonomic importance. Körnicke and Werner (*126*) recorded the yields of the varieties grown at Poppelsdorf in the description of each variety. In the present work the writers have mentioned productivity or yield of only those varieties that experiments have shown to be distinctly high or low in yield in certain areas.

QUALITY

Next to productivity, the value of wheat varieties for milling and for making bread, cake, pastries, macaroni, and other baking products is of the greatest economic importance, as these are the principal uses for wheat. Flour from hard red winter, hard red spring, and hard white varieties is used mostly for breadmaking. The soft white common, club, and soft red common varieties are used mostly for the manufacture of cake, cooky, pastry, biscuit, and cracker flours, for breakfast cereal products, or for bread when blended with high protein hard wheats. Durum varieties are used for macaroni and similar products. Varieties differ greatly in their usefulness for these various products. As with yield, these differences can be accurately determined only by careful experiments, conducted with comparably grown samples. The percentage of protein in grain is determined chiefly by the environment under which it is grown, but some varieties are consistently higher or lower than others. The quality of the protein is determined chiefly by variety. Where quality differences are known to exist they are pointed out, following the descriptions.

HARDINESS

Hardiness is the ability of the plant to resist low temperature, heaving, winter drought, and many other factors that may cause injury or death to the plant. In the case of winter wheats, resistance to low temperatures consists of the ability to survive low winter temperatures; in the case of spring wheats, it is the ability to resist injury from spring, summer, or fall frosts. Winterkilling in the hard red winter region is more commonly caused by low temperatures and drought, while in the more humid soft winter wheat region of the Eastern States it is often caused by heaving as well as low temperatures without snow cover. Following the varietal descriptions, the writers have indicated a few varieties that are known to be especially winter-hardy or nonhardy, but otherwise the character is not mentioned.

RESISTANCE TO DISEASE AND INSECTS

Wheat varieties are known that have more or less resistance to each of the many diseases of wheat and to some insects. Nearly all varieties of wheat herein considered have been grown in nurseries where they were inoculated either naturally or artificially with stem rust, leaf rust, stripe rust, bunt or stinking smut, loose smut, flag smut, powdery mildew, and mosaic or were exposed to infestation by hessian fly or greenbugs. Immunity and resistance can be determined when varieties are exposed equally to a disease or insect under conditions favorable for its development. When a variety is known to be resistant to a disease or some races or to an insect, this fact is noted following the varietal descriptions.

CLASSIFICATION OF THE GENUS TRITICUM

Wheat belongs to the grass family Gramineae (Poaceae) and to the tribe Hordeae, in which the one- to several-flowered spikelets are sessile

and alternate on opposite sides of the rachis, forming a true spike. Wheat is located in the genus *Triticum*, where the solitary two- to several-flowered spikelets are placed sidewise against the curved channeled joints of the rachis.

Wheat is characterized as a mid-tall annual grass with flat blades and a terminal spike. The spikelets are solitary, one- to five-flowered, sessile, arranged alternately on the nodes of a zigzag, channeled, articulate rachis; the glumes keeled, rigid, three- to several-nerved, obtuse, acute or acuminate; the lemmas keeled or rounded on the back, many-nerved, ending in a single tooth or awn.

The following eight divisions of the genus *Triticum* were used by Hackel (*91, pp. 180–187*) and recognized by others for many years:

- *Triticum*
  - *sativum*
    - *tenax*
      - *vulgare* Vill — Common wheat.
      - *compactum* Host — Club wheat.
      - *turgidum* L. — Poulard wheat.
      - *durum* Desf. — Durum wheat.
    - *dicoccum* Schrank — Emmer.
    - *spelta* L. — Spelt.
  - *polonicum* L. — Polish wheat.
  - *monococcum* L. — Einkorn.

In recent years the species of wheat have been classified on the basis of chromosome numbers. Sakamura in 1918 (*174*) reported the numbers for each of the above species or subspecies and his counts have since been verified by Sax (*177*), Kihara (*119, 120, 121*), Watkins (*224*), and others.

New species of wheat have been described since 1920 and the classification of Flaksberger and coworkers, 1939 (*80*), includes all those known at the present time. The species recognized by Flaksberger, grouped according to chromosome number, with their common names used in the United States, are as follows:

Diploid series	*Tetraploid series*	*Hexaploid series*
14 chromosomes	28 chromosomes	42 chromosomes
T. spontaneum Flaks., wild einkorn.	*T. dicoccoides* Körn., wild emmer.	*T. spelta* L., spelt.
T. monococcum L., einkorn.	*T. timopheevi* Zhuk., timopheevi.	*T. vulgare* (Vill.) Host (*T. aestivum* L.), common wheat.
	T. dicoccum Schrank, emmer.	*T. compactum* Host, club wheat.
	T. durum Desf., durum wheat.	*T. sphaerococcum* Perc., shot wheat.
	T. abyssinicum Steud., Abyssinian wheat.	*T. macha* Dek. & Men., macha.
	T. turgidum L., poulard wheat.	
	T. polonicum L., Polish wheat.	
	T. persicum (Boiss.), Aitch., & Hemsl., Persian wheat.	

A translation of the key to the species of *Triticum* prepared by Flaksberger et al. (*80*) was given by Clark and Bayles (*44, pp. 38–40*).

Spelt

Spelt may be of either winter or spring habit and awnless or awned. It has a long, narrow, lax spike and a brittle rachis. The pedicel (internode of the rachis) is long and wide, and after threshing remains attached to the face of the spikelet below the one that it bears. The spikelets are two-kerneled, arched on the inner side, and closely appressed to the rachis. The kernels, which remain enclosed in the glumes after threshing, are pale red, long, and laterally compressed, and have an acute tip and a narrow, shallow crease.

Spelt is grown commercially only to a slight extent in the United States. Spikes, glumes, a spikelet, and kernel of the Red Winter variety of spelt are shown in figure 19, *A*.

Emmer

Emmer is often incorrectly called "speltz" in the United States. Emmer may be of either winter or spring habit and usually is awned. The culms often are pithy within, and the leaves usually are pubescent. The rachis is brittle. The spikes are very dense and laterally compressed, being narrow when viewed from the face of the spikelet and wide from the edge view. The pedicel (internode of rachis) is short, narrow, and pointed and remains attached to the base of the spikelet which it bears. The spikelets are flattened on the inner side and usually contain two flowers. The kernels, which remain enclosed in the glumes after threshing, are red or white, long, and slender, with both ends acute.

Emmer is distinguished from spelt by the shorter, denser spikes, which are laterally compressed. The pedicel of emmer is shorter and narrower and is usually attached to the base of the spikelet which it bears, whereas in spelt the pedicel remains attached to the face of the next lower spikelet. The inner side of the spikelet is flat instead of arched, and the kernel usually is darker red than that of spelt. A spike, glumes, a spikelet, and kernel of the Vernal variety of emmer are shown in figure 19, *B*.

In the United States only a very small acreage of emmer is grown, and it is used as feed for livestock.

Poulard Wheat

The poulard wheats may be of either winter or spring habit and usually are tall with broad leaves. The culms are thick, usually solid, but sometimes pithy. The spikes are long and occasionally compound or branched. The spikelets are compactly arranged on the spike, and the glumes are short and sharply keeled. The kernels are thick, humped, and mostly hard, but usually are very starchy (yellow berry). A spike, glumes, and kernels of the Alaska variety of poulard wheat are shown in figure 20, *A*.

The poulards are most closely related to the durums. The glumes and kernels usually are shorter and the kernels thicker in the dorsoventral diameter and are somewhat softer. In many instances the varieties of poulard and durum are so nearly alike that it is difficult to distinguish them.

Only a very limited acreage of poulard wheat is cultivated in the United States, and the grain is of no commercial value except as feed for stock.

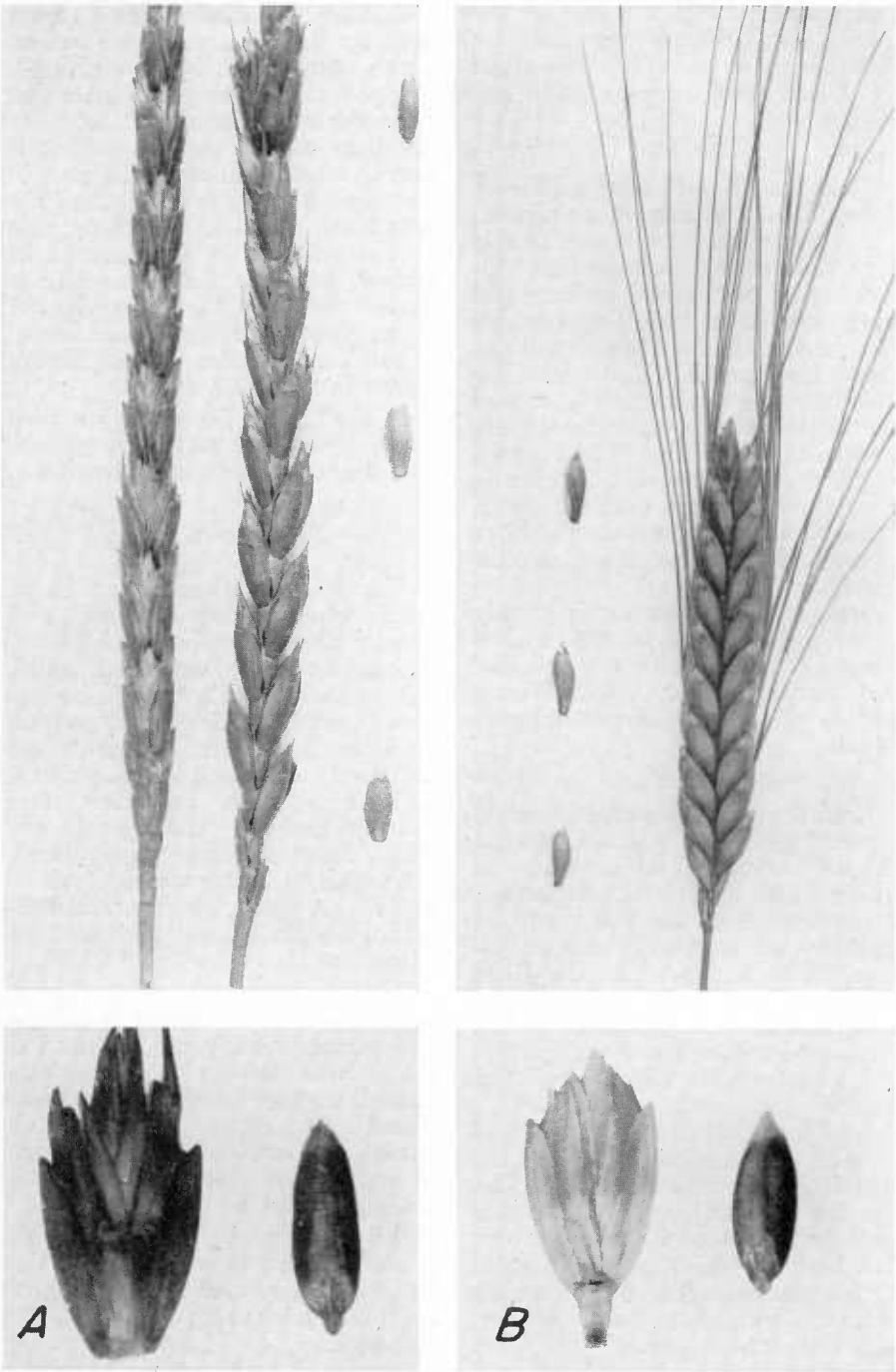

FIGURE 19.—*A*, Red Winter spelt and *B*, Vernal emmer: Spikes and glumes, × 1; kernels, × 3.

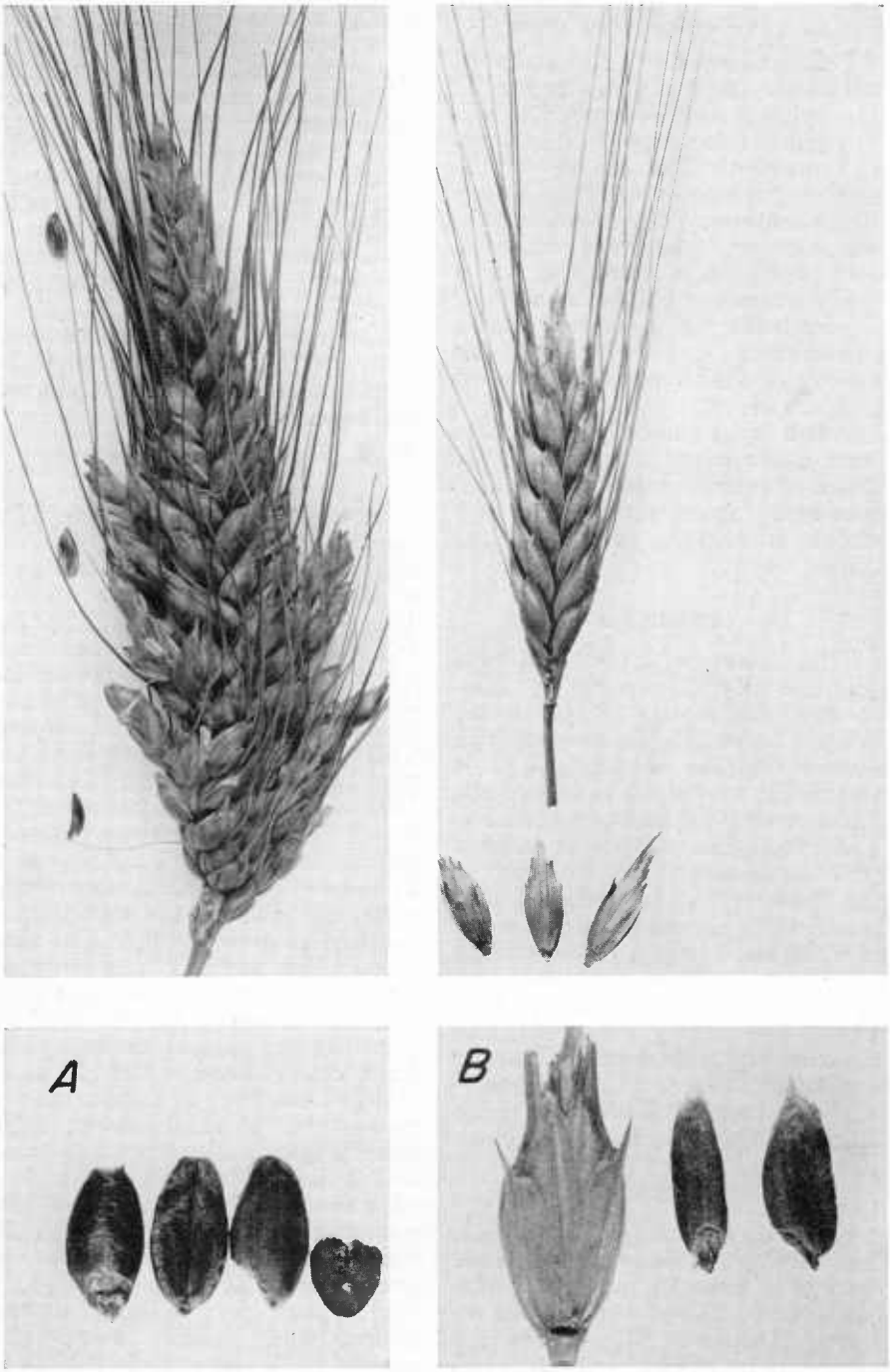

FIGURE 20.—*A*, Alaska (poulard) wheat and *B*, timopheevi: Spikes and glumes, × 1; kernels, × 3.

Polish Wheat

Polish wheat has a spring habit, tall stems, and a pithy peduncle. The spike is awned, large, and lax. The glumes are papery, very long, and narrow. The length of the glume equals or exceeds the length of the lemmas. The kernel is long and narrow, sometimes nearly a half inch long, is hard, and has a shape somewhat similar to that of a kernel of rye. A spike, glumes, and kernels of the White Polish variety of Polish wheat are shown in figure 21, *A*.

Polish wheat usually yields less than other adapted varieties. It also is of inferior value for bread or macaroni manufacture. Polish wheat is seldom grown in the United States.

Timopheevi

Timopheevi wheat, which was only recently discovered by Zhukovsky (*233*), is of particular interest because of its resistance to several diseases of wheat. It is very highly resistant to stem rust, leaf rust, stinking smut, and mildew. The cytological studies of Kihara (*122*) have shown that it belongs to the emmer group but contains one genome not present in other species of *Triticum*. It is a late-maturing spring type. The grain does not thresh free of the glumes. The glumes are densely pubescent, and the leaves have hairs on both upper and lower surface. A spike, spikelets, and kernels of timopheevi are shown in figure 20, *B*.

Einkorn

Einkorn, or one-grained wheat, has no English name but is called einkorn in German, and that name has become fairly well known in North America. The spikes are awned, narrow, slender, and laterally compressed. The spikelets usually contain only one fertile floret, for which reason it is called one-grained wheat. The terminal spikelets are aborted. The palea splits into two parts at maturity. The kernels that remain in the spikelets after threshing, are pale red, slender, and very much compressed. The kernel crease is almost wanting. A spike, glumes, a spikelet, and kernels of einkorn are shown in figure 21, *B*.

Einkorn is not grown commercially in North America, and the species itself has no economic importance.

Common Wheat

In the Species Plantarum, Linnaeus in 1753 (*134*) first used the name *Triticum aestivum* for a part of the common and club wheats. This name originally referred to the awned spring forms. It has been given priority use by botanists for the name of the species more commonly recognized as *T. vulgare*. This name was applied to the common wheats by Host in 1805 (*107, v. 3*) when it became apparent that Linnaeus' separations were not logical or correct. As the name *T. vulgare* is in general use among cereal agronomists the world over, the writers give preference to that form, which has also been accepted by Flaksberger and associates (*80*).

Common wheat has pairs of 21 chromosomes and is distinguished from club wheat, which it most closely resembles, by a spike long in proportion to its thickness. The spike is usually dorsally compressed and is thus wide when seen in face view of the spikelets instead of narrow, as with those of some other divisions. The spikelets are two- to five-flowered, far apart, only slightly overlapping, pressed close to the rachis, and nearly erect. The glumes are keeled only in the upper half, shorter than the lemmas,

FIGURE 21.—*A*, White Polish (Polish) wheat and *B*, einkorn: Spikes and glumes, × 1; kernels, × 3.

firm, and either glabrous or pubescent. The lemmas are awnless or have awns less than 10 cm. long. The palea is as long as the lemmas and remains entire at maturity. The culm of the plant usually is hollow, but occasionally is pithy within, and varies in strength and height. The blades of the leaves are usually narrower than those of the durum and poulard wheats. The kernels may be either soft or hard and white or red.

The characteristic of common wheat of greatest economic value is its well-known quality for breadmaking, as common wheat excels all the other divisions of the genus in this respect. It is also the best known and most widely cultivated of all the species. The varieties are most nearly related to the club wheats (*T. compactum.*) These two divisions have the same chromosome number and cross readily. There are intermediate types that resemble both common and club wheats.

Common wheat is adapted to widely varying climatic conditions and possesses more diverse characters than any of the other divisions. The 204 varieties cultivated in the United States are distinguished by the accompanying key.

KEY TO THE VARIETIES OF COMMON WHEAT

		Page
1a. Spike awnless to awnleted.		
2a. Glumes glabrous.		
3a. Glumes white.		
4a. Kernels white (*Triticum vulgare albidum* Alef.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Winter habit.		
Spike fusiform to oblong	Yorkwin	50
Spike oblong.		
Keel straight above, shoulders wide.	Greeson	52
Keel incurved above, shoulders wanting to oblique.	White Winter	52
Spike oblong to clavate	Brevor	52
Spike clavate	Wilhelmina (Holland)	53
Spring habit.		
Spike fusiform.		
Awnlets few	Defiance	53
Awnlets many, incurved	Rink	53
Spike oblong.		
Plant early to midseason.		
Spike awnless.		
Spike fusiform to oblong	Idaed	53
Spike oblong	Lemhi	55
Spike apically awnleted	Onas	55
Resistant to bunt	Onas 41	55
Spike awnleted	Bunyip	57
Plant midseason.		
Spike awnless	Marfed	57
Spike apically awnleted	Cascade	57
Plant late	Pacific Bluestem	57
Resistant to bunt	Pacific Bluestem 37	59
Spike clavate.		
Plant early to midseason.		
Spike apically awnleted	Major	59
Spike awnleted	Oregon Zimmerman	59
Plant late.		
Stem very glaucous	Dicklow	59

See footnote at end of key.

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

		Page
1a. Spike awnless to awnleted—Continued		
2a. Glumes glabrous—Continued		
3a. Glumes white—Continued		
4a. Kernels white—Continued		
Kernels short to midlong—Continued		
Kernels semihard to hard.		
Spring habit.		
Spike fusiform	Florence (Quality)	60
Spike oblong.		
Susceptible to bunt and rust	White Federation	60
Resistant to bunt and rust	White Federation 38	60
Kernels midlong to long.		
Kernels soft.		
Spring habit.		
Spike clavate	Pilcraw	60
4b. Kernels red (*T. vulgare lutescens* Alef.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Winter habit.		
Stem white.		
Spike fusiform.		
Plant early.		
Spike erect, awnlets 2 to 15 mm. long.	Rice	60
	Early Premium	64
Spike nodding, lax.		
Awnlets few, 3 to 10 mm. long.	Leap	64
Awnlets several, 5 to 25 mm. long.	Leapland	64
Plant midseason.		
Spike erect.		
Awnlets several, 5 to 20 mm. long.	Vahart	64
Spike inclined.		
Apically awnleted	Kanqueen	64
Awnlets few, 3 to 15 mm. long.	Vigo	66
Awnlets several, 5 to 30 mm. long.	Lofthouse	66
Spike nodding, lax	Wabash	66
Spike oblong.		
Plant midseason.		
Spike erect to inclined.		
Spike lax	Fairfield	67
Spike middense	Clarkan	67
Spike dense.		
Awnlets, 3 to 10 mm. long.	Harvest Queen	69
Awnlets, 5 to 15 mm. long.	Pennoll	69
Spike nodding.		
Awnlets straight, 3 to 10 mm. long.	Prosperity	69
Awnlets incurved, 5 to 15 mm. long.	Forward	69
Spike clavate.		
Plant midseason	Valprize	70
Plant very late	Red Russian	70

See footnote at end of key.

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

		Page
1a. Spike awnless to awnleted—Continued		
2a. Glumes glabrous—Continued		
3a. Glumes white—Continued		
4b. Kernels red—Continued		
Kernels short to midlong—Continued		
Kernels soft to semihard—Continued		
Winter habit—Continued		
Stem purple.		
Spike fusiform.		
Plant midseason.		
Shoulders narrow, rounded	Nured	70
Shoulders midwide, rounding to square.	Fulhio	70
	Fultz	70
	Trumbull	70
	Ashland	73
Spike clavate	Fultzo-Mediterranean	73
Intermediate habit.		
Stem white.		
Spike fusiform.		
Awnlets 3 to 10 mm. long	Carala	73
Awnlets 5 to 20 mm. long.		
Plant early	Redhart	73
Plant midseason	Taylor	73
Spike fusiform to oblong.		
Awnlets 5 to 20 mm. long	Hardired	74
Spike oblong	Coker 47–27	74
Spike oblong to clavate.		
Awnlets 3 to 10 mm. long	Atlas 66	74
Awnlets 5 to 20 mm. long	Atlas 50	76
Stem purple.		
Spike fusiform.		
Susceptible to leaf rust	Purplestraw	76
	Gasta	76
Resistant to leaf rust and mosaic.	Chancellor	76
Resistant to leaf rust	Sanford	76
Spike oblong	Flint	77
Spring habit.		
Stem white.		
Spike fusiform	Coastal	77
Stem purple.		
Awnlets 3 to 10 mm. long	Huston	77
Awnlets 5 to 25 mm. long	Seabreeze	79
Kernels semihard to hard.		
Winter habit.		
Spike fusiform.		
Awnlets few, 3 to 12 mm. long.		
Kernels ovate, germ small	Newturk	79
Kernels elliptical, germ mid-sized.	Ridit	79
Awnlets several, 3 to 25 mm. long.		
Kernels short to midlong	Purkof	79
Kernels midlong.		
Glumes white	Cache	80
Glumes white with black pigment.	Chiefkan	80
Spike oblong.		
Awnlets several, 3 to 12 mm. long.	Michikof	80
Awnlets several, 5 to 25 mm. long.	Mosida	80

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

		Page
1a. Spike awnless to awnleted—Continued		
2a. Glumes glabrous—Continued		
3a. Glumes white—Continued		
4b. Kernels red—Continued		
Kernels short to midlong—Continued		
Kernels semihard to hard—Continued		
Spring habit.		
Stem white.		
Plant early.		
Spike awnless	Red Bobs	82
	Supreme	82
Spike awnleted.		
Spike fusiform.		
Kernels short	Redman	82
Kernels short to midlong	Garnet	82
Spike oblong	Comet	84
Plant early to midseason.		
Kernels short.		
Awnlets 5 to 20 mm. long	Thatcher	84
	Newthatch	86
Kernels midlong.		
Awnlets 5 to 20 mm. long.		
Plant short to midtall	Marquillo	86
Plant midtall to tall	Carleeds (Nordhougen)	86
Plant midseason to late.		
Kernels short.		
Awnlets 3 to 10 mm. long.		
Stem hollow	Marquis	87
Stem solid	Rescue	88
Awnlets 5 to 15 mm. long	Apex	90
Awnlets 5 to 20 mm. long	Cadet	90
Stem purple.		
Plant early.		
Awnlets 3 to 10 mm. long	Rushmore	90
Awnlets 5 to 20 mm. long	Saunders	92
Plant early to midseason.		
Awnlets 2 to 10 mm. long.		
Spike fusiform, erect	Renown	92
Spike oblong, inclined	Regent	92
Spike oblong to subclavate	Kitchener	94
3b. Glumes brown.		
4a. Kernels white (*T. vulgare alborubrum* Koern.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Winter habit.		
Spike awnless.		
Spike oblong, stem white	Rex	94
Spike awnleted.		
Spike fusiform, stem purple	Cornell 595	94
Spike oblong, stem white.		
Awnlets 1 to 3 mm. long	Genesee	95
Awnlets 3 to 20 mm. long	Dawson	95
Spike clavate, stem purple.		
Spike middense, erect to inclined.	Goldcoin (Fortyfold)	95
Spike dense, erect	Golden	97
Spring habit.		
Spike oblong	Federation	97
Resistant to bunt	Federation 41	98
Kernels semihard to hard.		
Spring habit.		
Spike middense to lax	Ramona 44	98
Spike dense	Hard Federation	98
	Hard Federation '31	98

See footnote at end of key.

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

		Page
1a. Spike awnless to awnleted—Continued		
2a. Glumes glabrous—Continued		
3b. Glubes brown—Continued		
4b. Kernels red (*T. vulgare miltura* Alef.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Winter habit.		
Stem white.		
Spike fusiform.		
Plant midseason.		
Awnlets 3 to 10 mm. long	Moking	99
Awnlets 5 to 15 mm. long	Red Wave	99
Spike oblong	Purdue No. 1	99
Stem purple.		
Spike fusiform.		
Plant early, midtall	Currell	99
Plant midseason, midtall to tall.		
Beaks 0.5 mm. long.		
Awnlets 3 to 12 mm. long	Baldrock	99
Awnlets 5 to 20 mm. long	Poole	101
Beaks 1 to 1.5 mm. long	Russian Red	101
Spike oblong.		
Plant early.		
Awnlets several, 5 to 25 mm. long.	Purcam	101
Plant midseason.		
Awnlets few, 3 to 15 mm. long.	Red May (Michigan Amber).	101
Awnlets several, 5 to 25 mm. long.	Thorne	103
	Seneca	103
Kernels midlong to long	Anderson	103
3c. Glumes brown with black pigment.		
4b. Kernels red.		
Kernels hard	Red Chief	103
2b. Glumes pubescent.		
3a. Glumes white.		
4b. Kernels red (*T. vulgare villosum* Alef.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Winter habit.		
Spike inclined; kernels semihard	Triplet	106
Spike nodding; kernels soft	Jones Fife	106
Kernels hard.		
Spring habit.		
Plant early, short	Reward	106
3b. Glumes brown.		
4a. Kernels white (*T. vulgare delfi* Koern.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Spring habit.		
Spike fusiform; beaks acute	Galgalos	106
Spike oblong; beaks acuminate	Sonora	108
1b. Spike awned.		
2a. Glumes glabrous.		
3a. Glumes white.		
4a. Kernels white (*T. vulgare graecum* Koern.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Spring habit	Awned Onas	108
Spring intermediate habit	Orfed	108

See footnote at end of key.

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

		Page
1b. Spike awned—Continued		
2a. Glumes glabrous—Continued		
3a. Glumes white—Continued		
4a. Kernels white—Continued		
Kernels long.		
Kernels semihard.		
Spring habit.		
Susceptible to rust and bunt	Baart	110
Resistant to some races of rust and bunt.	Baart 38	110
	Baart 46	110
4b. Kernels red (*T. vulgare erythrospermum* Koern.).[1]		
Kernels short to midlong.		
Kernels soft to semihard.		
Winter habit.		
Stem white.		
Beaks 1 to 3 mm. long	Gladden	111
	Saline	111
	Blackhawk	111
Beaks 2 to 8 mm. long.		
Plant midtall	Gipsy	111
Plant midtall to tall	Royal	111
	Newcaster	113
Plant tall	Valley	113
Stem purple.		
Spike fusiform.		
Beaks 1 to 3 mm. long	Kawvale	113
Beaks 2 to 8 mm. long.		
Plant midtall.		
Plant midseason	Red Indian	113
Plant late	Mammoth Red	114
Plant tall	Fulcaster	114
	Nudel	115
	V. P. I. 131	115
Spike oblong.		
Beaks 1 to 2 mm. long	Butler	115
Beaks 2 to 10 mm. long	Nittany	115
Spring habit.		
Beaks 2 to 10 mm. long	Progress	115
Kernels semihard to hard.		
Winter habit.		
Stem white.		
Plant very early.		
Glumes white	Triumph	117
Glumes white with black pigment.		
Kernels short to midlong	Wichita	117
Kernels midlong	Early Blackhull	117
Plant early.		
Glumes white.		
Kernels short to midlong.		
Beaks 3 to 5 mm. long	Pawnee	118
Beaks 5 to 15 mm. long	Ponca	118
Spike fusiform	Westar	120
Spike oblong.		
Winter habit	Comanche	120
Winter intermediate habit.	Quanah	121
Kernels midlong.		
Beaks 3 to 10 mm. long	Apache	121
Glumes white with black pigment.		
Kernels midlong.		
Beaks 2 to 3 mm. long	Kiowa	122

See footnote at end of key.

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

1a. Spike awned—Continued
2a. Glumes glabrous—Continued
3a. Glumes white—Continued
4b. Kernels red—Continued
Kernels short to midlong—Continued
Kernels semihard to hard—Continued
Winter habit—Continued
Stem white—Continued
Plant midseason.
Glumes white.
Stem white.

		Page
Beaks 1 to 2 mm. long.		
Spike inclined	Marmin	122
Spike nodding	Yogo	122
Beaks 2 to 5 mm. long.		
Spike fusiform.		
Spike middense	Minturki	123
	Minter	123
Spike lax	Relief	123
	Wasatch	124
Spike oblong to fusiform, dense.	Cheyenne	124
Beaks 2 to 8 mm. long.		
Spike fusiform, middense.	Turkey	126
	Karmont	127
	Montana No. 36	128
	Nebraska No. 60	128
	Nebred	128
	Sioux	128
	Rio	128
	Reliant	128
	Ioturk	130
Beaks 3 to 30 mm. long.		
Kernels short to midlong.	Tenmarq	130
Kernels midlong.		
Spike fusiform.		
Spike lax	Sherman	130
Spike middense.		
Glumes white	Kanred	130
Glumes yellowish.	Utah Kanred	131
Stem purple.		
Beaks 2 to 8 mm. long	Wisconsin Pedigree No. 2	131
Beaks 2 to 25 mm. long.		
Spike inclined	Sibley 81	131
Spike nodding	Iowin	132
Glumes white with black pigment.		
Stem white.		
Beaks 1 to 3 mm. long	Blackhull	132
	Blue Jacket	132
Plant late.		
Spike lax, beaks 2 to 3 mm. long.		
Kernels midlong, semihard to hard.	Orienta	133
Kernels midlong to long, semihard.	Stafford	133

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

		Page
1b. Spike awned—Continued		
2a. Glumes glabrous—Continued		
3a. Glumes white—Continued		
4b. Kernels red—Continued		
Kernels short to midlong—Continued		
Kernels semihard to hard—Continued		
Spring habit.		
Spike fusiform.		
Stem white.		
Plant midseason.		
Beaks 0.5 mm. long	Spinkcota	133
Beaks 1 to 5 mm. long.		
Kernels short	Sturgeon	133
Kernels midlong	Komar	135
Beaks 2 to 10 mm. long.		
Kernels short to midlong	Canus	135
Kernels midlong	Ceres	135
Beaks 5 to 20 mm. long	Vesta	135
Stem purple.		
Plant midseason.		
Beaks 1 to 5 mm. long	Henry	136
Beaks 2 to 10 mm. long	Hope	136
	Pilot	136
Beaks 5 to 20 mm. long	Rival	138
Awns black	Mida	138
	Premier	140
Spike oblong to fusiform, stem white, plant early.	Lee	140
Kernels midlong to long.		
Kernels soft to semihard.		
Winter habit.		
Stem purple.		
Glumes white	Nigger	140
	Nabob	140
Glumes white with black pigment.	Rudy	140
3b. Glumes brown.		
4a. Kernels white (*T. vulgare erythroleucon* Koern.).[1]		
Kernels midlong.		
Kernels soft.		
Winter habit	Requa	141
Kernels hard.		
Spring habit	Sevier	141
4b. Kernels red (*T. vulgare ferrugineum* Alef.).[1]		
Kernels short to midlong.		
Kernels soft.		
Winter habit.		
Beaks 1 to 3 mm. long	Goens	141
Beaks 5 to 8 mm. long	Prairie	143
Kernels semihard to hard.		
Winter habit.		
Kernels short.		
Beaks 2 to 10 mm. long	Iobred	143
Beaks 8 to 15 mm. long	Iohardi	143
Kernels midlong.		
Beaks 1 to 5 mm. long	Brill	143
Beaks 2 to 10 mm. long.		
Glumes brown with black pigment.	Red Jacket	144
	Redhull	144

See footnote at end of key.

KEY TO THE VARIETIES OF COMMON WHEAT—Continued

1b. Spike awned—Continued
2a. Glumes glabrous—Continued
3b. Glumes brown—Continued
4b. Kernels red—Continued
Kernels midlong to long.
Kernels soft to semihard.

		Page
Winter habit.		
Stem white	Denton	144
Stem purple	Mediterranean	144
	Red Rock	145
Intermediate habit.		
Beaks 5 to 8 mm. long	Austin	145
Spring habit.		
Plant early	Kentana	146
Plant midseason	Supremo	146

[1] The correct botanical name for common wheat is *Triticum aestivum* L. The trinomials made by Alefeld and others under *T. vulgare* cited in the key have never been transferred to *T. aestivum* and are quoted in the form in which they were originally published.

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONYMY OF COMMON WHEAT VARIETIES

YORKWIN

Description.—Plant winter habit, midseason, midtall; stem white, midstrong to strong; spike awnleted, fusiform to oblong, middense, inclined; glumes glabrous, white, short to midlong, midwide; shoulders midwide, oblique to square; beaks wide, obtuse, 0.5 mm. long; awnlets few, 5 to 15 mm. long; kernels white, midlong, soft, elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 22, *A*.)

History.—Yorkwin (C. I. 11855) was selected from a cross between Dietz (Fulcaster) and Goldcoin made in 1919. The last selection was made in 1924, and the strain was distributed to growers in 1936 (*137*). Prior to being named Yorkwin the strain was known as No. 254A1–101–19. Yorkwin was developed by the Cornell University Agricultural Experiment Station in cooperation with the United States Department of Agriculture. On account of its winter hardiness and high yield, Yorkwin became the leading variety in New York and Michigan.

Distribution.—Estimated area in 1949 was 1,107,530 acres (fig. 23).

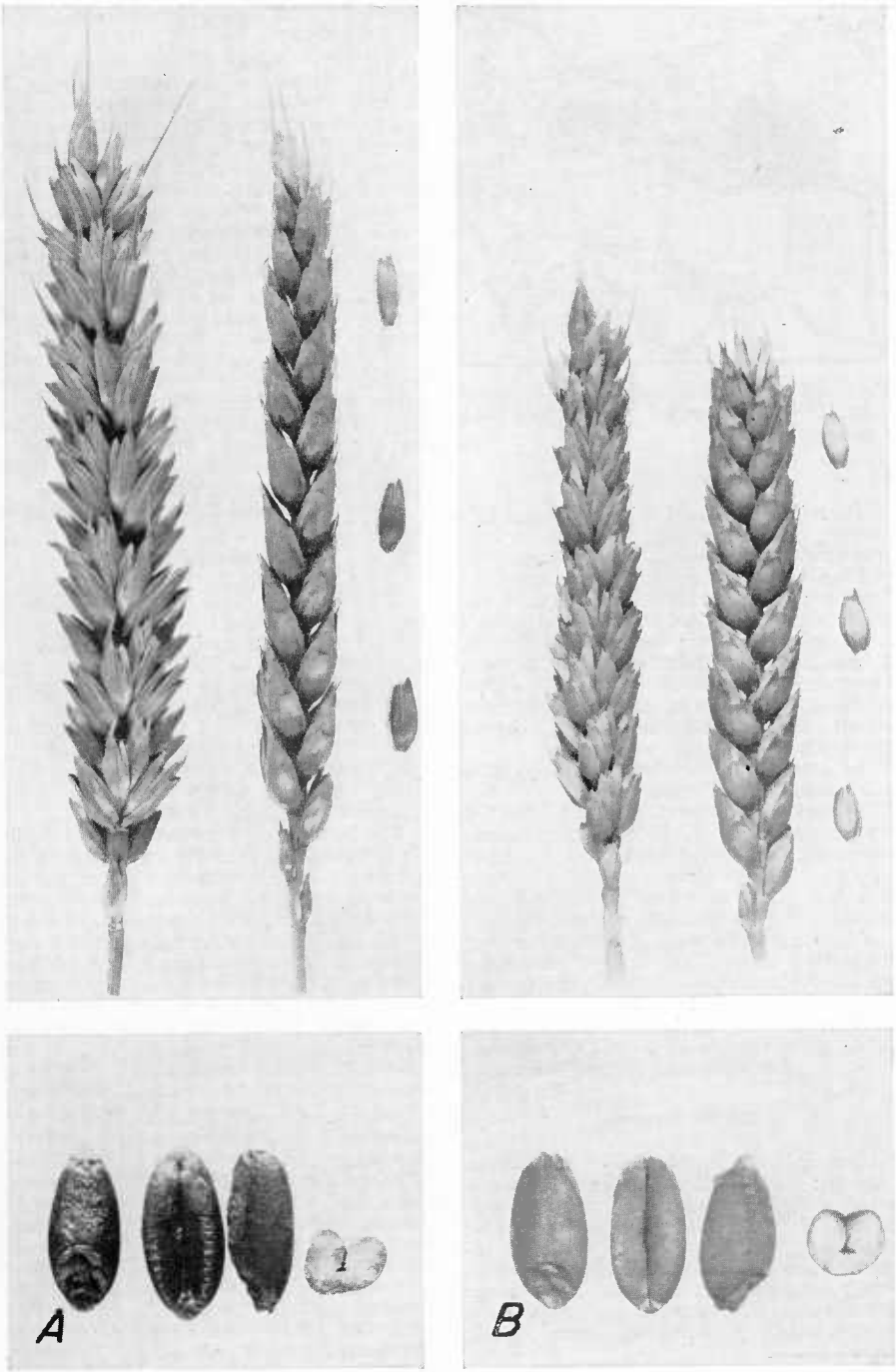

FIGURE 22.—*A*, Yorkwin and *B*, Brevor wheats: Spikes and glumes, × 1; kernels, × 3.

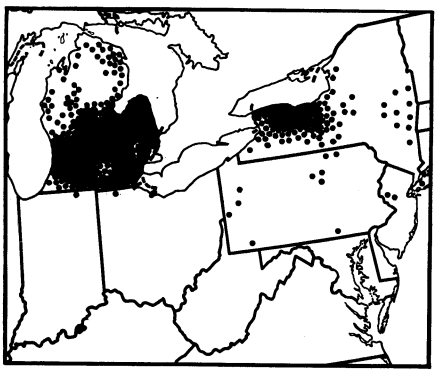

FIGURE 23.—Distribution of Yorkwin wheat in 1949. Estimated area, 1,107,530 acres.

GREESON

Description.—Plant winter habit, midseason, midtall; stem glaucous, white, midstrong to strong; spike awnleted, oblong to fusiform, middense, erect to inclined; glumes glabrous, white, midlong, wide; shoulders wide, square to elevated; keel straight above; beaks wide, obtuse, 1 mm. long; awnlets few, 2 to 20 mm. long, somewhat incurved; kernels white, midlong, soft, ovate, acute; germ midsized; crease midwide, deep; cheeks rounded; brush small, midlong.

As grown commercially, Greeson contains a mixture of red kernels.

History.—Greeson (C. I. 6320) (reg. [6] 4) was recorded by J. I. Wagoner, county agent of Guilford County, N. C. (*220, p. 10*). George Greeson of that county found a plant of wheat growing beside an old stump in his apple orchard in 1896. He increased the seed and distributed it under the name Wild Goose. After the death of Mr. Greeson in 1899, the variety was called Greeson.

Distribution.—Estimated area in 1949, 2,452 acres, grown in North Carolina.

Synonyms.—Gleason, Greensboro.

WHITE WINTER

Description.—Plant winter habit, late, midtall; stem white, strong; spike awnleted, oblong, dense, erect; glumes glabrous, white, midlong, broad at base; shoulders wanting to oblique; keel incurved above; beaks wide, obtuse, 1 mm. long; awnlets few, 3 to 20 mm. long; kernels white, short to midlong, soft, ovate, slightly humped; germ small; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

History.—White Winter (C. I. 5219) (reg. 5) is one of the oldest wheats in western Oregon. It is reported to have been one of the principal wheats raised in Oregon Territory in 1855 (*87*). Joseph Connell, of Hillsboro, Oreg., reported in the wheat varietal survey of 1917 that Wold's White Winter, a synonym for White Winter, originated in Kent County, England, and had been grown in Washington County, Oreg., for about 40 years. W. L. Bishop, of Dundee, Yamhill County, Oreg., claims that he originated it as a result of a hybrid obtained by sowing several varieties in a field and letting them cross naturally. Names other than White Winter have been applied to the variety at times, but none has become generally used

Distribution.—Estimated area in 1949, 3,829 acres, grown in western Oregon.

Synonyms.—Bishop's Pride, Wold's White Winter.

BREVOR

Description.—Plant winter habit, midseason, very short; stem white, very strong; spike awnleted, oblong to clavate, middense, erect to inclined; glumes glabrous, white, short to midlong, midwide; shoulders midwide, rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets few, 3 to 5 mm. long; kernels white, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 22, *B.*)

The leaves of Brevor have a characteristic flecking, particularly noticeable after heading. It is resistant to 23 of the 25 races of common bunt and moderately resistant to the other two races, L–8 and T–16. It is moderately resistant to dwarf bunt. It averaged among the highest yielding strains in tests covering 4 years both on dry land and under irrigation in the Pacific Northwest. The kernels of Brevor appear uniform in texture. It has only fair milling quality but has good quality for bread, family, and cake flours.

History.—Brevor (C. I. 12385) was Selection 1–3–11–5 from a cross between Brevon, a selection from a cross between (Turkey-Florence × Fortyfold-Federation), and an F_2 from the cross (Oro × Turkey-Florence) × (Oro × Fortyfold-Federation). The cross was made in 1938 at Pullman, Wash. (*217*). Brevor was released by the Washington Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, United States Department of Agricul-

[6] Reg. refers to registration number, explained on p. 14.

ture,[7] in the fall of 1949 when approximately 100 acres were sown. It is recommended for growing in Washington, Oregon, and Idaho.

WILHELMINA (HOLLAND)

Description.—Plant winter habit, late, midtall; stem white, strong; spike awnleted, clavate, dense, erect; glumes glabrous, white, short to midlong, midwide; shoulders narrow, wanting to round; beaks wide, obtuse, 0.5 mm. long; awnlets few, 3 to 10 mm. long; kernels white, short to midlong, soft, ovate, slightly humped; germ small; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 24, *A*.) Wilhelmina is slightly later and shorter and has a more dense, erect, and blockier spike White Winter.

History.—Wilhelmina, or Queen Wilhelmina (C. I. 11389) (reg. 279), was developed by Emeritus Prof. L. Broekema (*27*), of the agricultural high school, Wageningen, the Netherlands, by backcrossing a selection from Squarehead × Zeeuwsche on Squarehead. Zeeuwsche was grown extensively in the Netherlands about 1890. The original cross was made in 1885.

It was introduced under the name of Queen Wilhelmina from the Netherlands by the Oregon Agricultural Experiment Station about 1914 and distributed as Holland in the Willamette Valley of western Oregon, where it has partly replaced such varieties as White Winter.

Distribution.—Estimated area in 1949, 53,136 acres, grown in western Oregon, Idaho, and Washington.

Synonyms.—Holland, New Victory, Queen Wilhelmina, Victory, White Holland.

DEFIANCE

Description.—Plant spring habit, midseason, midtall to tall; stem white, weak to midstrong; spike awnleted, fusiform, middense, erect to inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, oblique to square; beaks wide, obtuse, somewhat incurved, 1 mm. long; awnlets few, 5 to 20 mm. long; kernels white, midlong, soft, ovate; germ usually small; crease wide, middeep; cheeks usually angular; brush midsized, midlong.

Defiance wheat is variable in many of the characters above described, indicating that there are several different strains within the variety.

History.—Defiance (C. I. 6477) (reg. 13) is the result of a cross of White Hamburg and Golden Drop, made by Cyrus G. Pringle, in the Champlain Valley, near Charlotte, Vt., in 1871. It was first distributed in 1878 by B. C. Bliss & Sons, as Pringle's Defiance. It showed three distinct types of grain. A. E. Blount took some of this wheat to the Colorado Agricultural Experiment Station, where he grew it during a number of years and made careful selections. Three other commercial varieties—Early Defiance, Escondido, and Regenerated Defiance—have been developed from it.

Distribution.—Estimated area in 1949, 1,488 acres, grown in Colorado.

Synonym.—Pringle's Defiance.

RINK

Description.—Plant spring habit, midseason, midtall; stem white, strong; spike awnleted, broadly fusiform, middense to dense, inclined; glumes glabrous, yellowish white, midlong, midwide; shoulders wide, usually square; beaks wide, acute, curved, 1 to 1.5 mm. long; awnlets many, 2 to 10 mm. long, occurring throughout the spike and distinctly incurved; kernels white, short to midlong, soft, ovate, slightly humped; germ usually small; crease midwide, deep; cheeks rounded; brush midsized, midlong to long.

This variety is distinct in having incurved awnlets throughout the length of the spike.

History.—The origin of Rink (C. I. 5868) (reg. 14) is undetermined. It was reported to have been grown in Washington County, Oreg., since 1909.

Distribution.—Estimated area in 1949, 959 acres, grown in western Oregon.

IDAED

Description.—Plant spring habit, early, short; stem white, midstrong; spike awnless, fusiform to oblong, dense, erect; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to square; beaks wide, obtuse, 0.5 mm. long; awnlets wanting; kernels white, short, soft to semihard, ovate; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong.

History.—Idaed (C. I. 11706) was developed in the coordinated wheat improvement program of the State agricultural experiment stations in the western region and the Division of Cereal Crops and Diseases. It resulted from a cross between Sunset and Boadicea (two Australian varieties) made at Davis, Calif., in 1920. The hybrid was carried in bulk until 1927 when a number of heads were selected. Selection 20172 VII–4, which was later named

[7] Hereinafter shortened to the Division of Cereal Crops and Diseases.

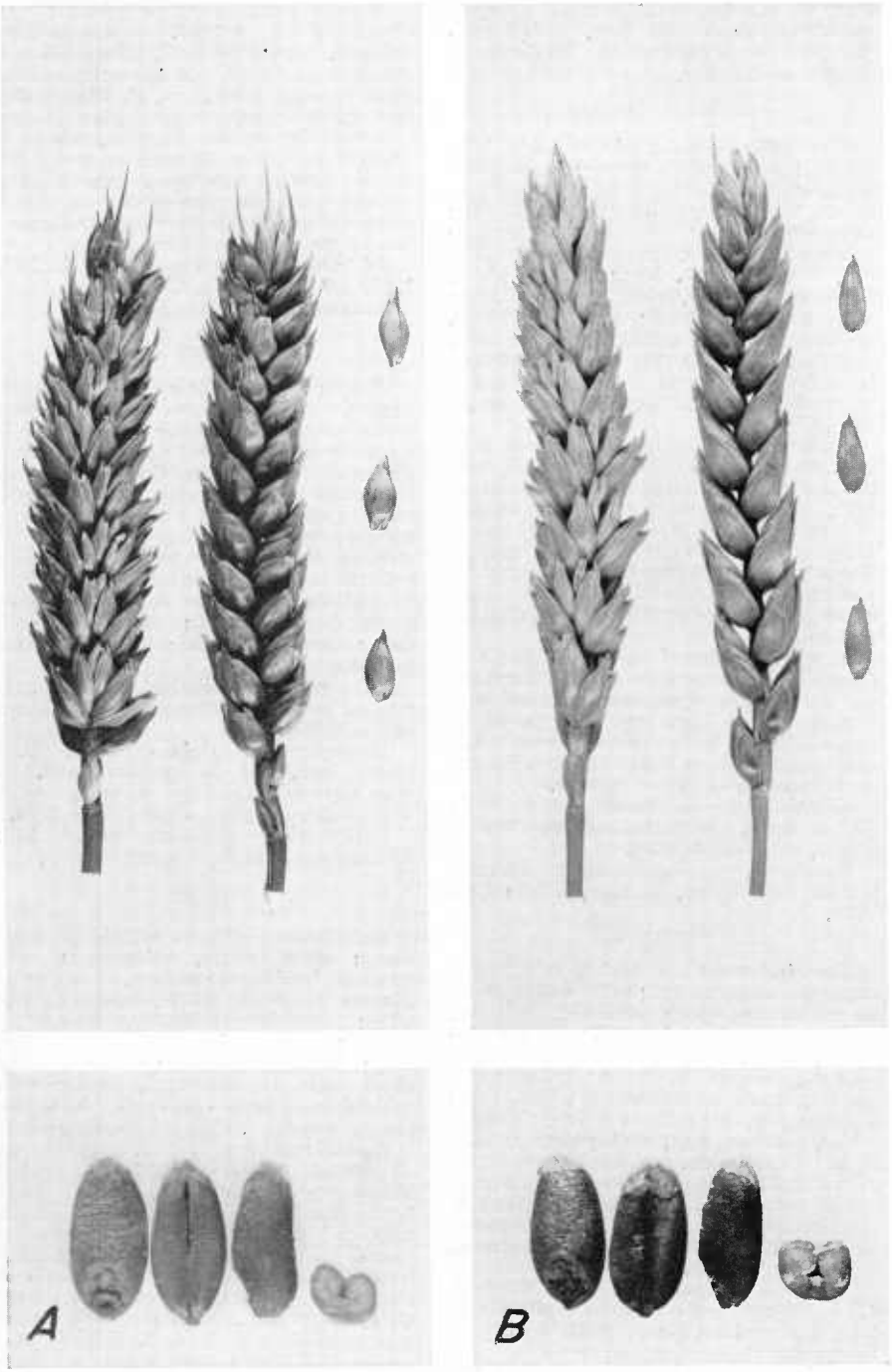

FIGURE 24.—*A*, Wilhelmina and *B*, Lemhi wheats: Spikes and glumes, × 1; kernels, × 3.

Idaed, showed considerable promise and was taken to Moscow, Idaho, for testing in 1931. Its value and adaptation were determined in the coordinated regional program. It was increased by the Idaho Agricultural Experiment Station and distributed in 1938.

Distribution.—Estimated area in 1949, 166,418 acres, grown in Idaho, Washington, and Oregon.

LEMHI

Description.—Plant spring habit, early to midseason, short; stem white, strong; spike awnless, oblong, dense, erect to inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique; beaks wide, obtuse, 0.5 mm. long; awnlets wanting; kernels white, short to midlong, soft, oval to ovate; germ midsized; crease wide, deep; cheeks rounded to angular; brush midsized, midlong. (See fig. 24, *B*.)

Lemhi combines the short stiff straw of Federation with the Dicklow characteristic of producing white flour low in carotenoid pigments. It is slightly earlier than Federation.

History.—Lemhi (C. I. 11415) was developed in cooperative investigations of the Idaho Agricultural Experiment Station and the Division of Cereal Crops and Diseases at the Aberdeen substation, from a cross between Federation and Dicklow made in 1921. The cross was grown in bulk until 1927 when heads were selected. The selection later named Lemhi was grown in the uniform irrigated nursery in the western region in 1931 and was so promising that it was made a uniform variety in field plots in 1935. It was released to growers in the irrigated districts of southern Idaho in the spring of 1939.

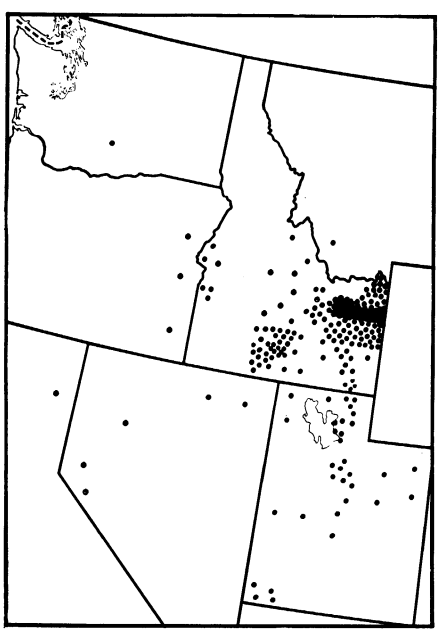

FIGURE 25.—Distribution of Lemhi wheat in 1949. Estimated area, 202,256 acres.

Distribution.—Estimated area in 1949, 202,256 acres, grown in seven States (fig. 25).

ONAS

Description.—Plant spring habit, early to midseason, short to midtall; stem white, strong; spike apically awnleted, oblong, dense, erect; glumes glabrous, white, short, wide; shoulders wide, oblique to square; beaks midwide to wide, obtuse, 0.5 mm. long; apical awnlets few, 0.5 to 5 mm. long; kernels white, short to midlong, soft, ovate; germ midsized; crease wide, middeep; cheeks rounded; brush small, midlong. (See fig. 26, *A*.)

History.—Onas (C. I. 6221) (reg. 252) was developed (*166*) by F. Coleman, of Tuela, Saddleworth, South Australia, from a cross between Federation and Tarragon, the latter in turn from a cross between Improved Fife and Tardent's Blue. Onas was introduced from Australia by the United States Department of Agriculture (*211*, P. I.[8] 46796) in 1918. After having been tested in cooperative experiments in the Pacific Coast States seed was distributed from University Farm at Davis, Calif., in 1923.

Distribution.—Estimated area in 1949, 49,661 acres, grown in California, Montana, and Wyoming.

ONAS 41

Description.—Onas 41 is resistant to several races of bunt but is otherwise similar to Onas.

History.—Onas 41 (C. I. 12229), which has the Martin factor for resistance to bunt, was developed in the backcrossing program of the California Agricultural Experiment Station. According to Suneson (*201*) it is a composite of 115 F_3 bunt-resistant lines grown in 1941 from the backcross (Martin-White Federation[3]) × Onas[6]. It was distributed in 1942 and probably comprised most of the acreage reported as Onas in California in 1949.

[8] P. I. refers to accession number of the Division of Plant Exploration and Introduction (formerly Foreign Plant Introduction).

FIGURE 26.—*A*, Onas and *B*, Bunyip wheats: Spikes and glumes, × 1; kernels, × 3.

BUNYIP

Description.—Plant spring habit, early, midtall; stem white, strong; spike awnleted, oblong, dense, erect; glumes glabrous, yellowish white (brown-striped), midlong, midwide; shoulders midwide, oblique to square; beaks narrow to midwide, acute, 0.5 mm. long; awnlets few, 3 to 12 mm. long; kernels white, midlong, soft to semihard, ovate; germ midsized; crease midwide, middeep; cheeks angular; brush midlong, midsized to large. (See fig. 26, *B.*)

The glumes of this variety are distinctly brown-striped, which sometimes gives it the appearance of a brown-glumed variety.

History.—Bunyip (C. I. 5125) (reg. 15) is an Australian variety originated by William Farrer, the well-known plant breeder of New South Wales, Australia. Its origin has been recorded (*203, p. 189*) as follows:

> It is a crossbred, produced as the result of mating two other crossbreds, Rymer and Maffra, together. Rymer, the mother plant, was produced as the result of crossing Purplestraw [a white grain Australian variety] on to Improved Fife, the latter being a Manitoba variety. Maffra was the product of King's Jubilee, mated with an unnamed crossbred (Blount's Lambrigg × Hornblende). . . . The cross was made in 1897, and named in 1901.

Bunyip was first introduced into the United States (*211,* P. I. 38345) in May 1914 by the United States Department of Agriculture. In 1915 a sample of the variety was included in the Australian exhibit at the Panama-Pacific International Exposition at San Francisco, Calif. A part of this seed was obtained, together with that of several other varieties, by the Sperry Flour Co., and grown on their experiment station near Stockton, Calif. Of several varieties grown, Bunyip was selected as the most promising and was increased and distributed for commercial growing in California.

Distribution.—Estimated area in 1949, 13,541 acres, grown in California.

MARFED

Description.—Plant spring habit, midseason, midtall; stem white, strong; spike awnless, oblong, dense, erect; glumes glabrous, white, short, midwide to wide; shoulders narrow to midwide, wanting to oblique; beaks midwide, acute, 0.5 mm. long; kernels white, short, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Marfed is resistant to 13 of 25 races of bunt to which it has been tested and is moderately resistant to mildew. It has a good test weight, but some lots do not mill so well as Federation. Marfed, while a spring wheat, is slightly more winter-hardy than Federation and may be fall-sown in areas with mild winters. It has outyielded Federation, especially from late-spring seedings.

History.—Marfed (C. I. 11919) was developed by the Washington Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross between a Marquis-Florence selection and Federation made at Pullman in 1931. The selection, Washington 3348, which resulted in Marfed was made in 1936. Two thousand bushels were distributed in Washington for growing in 1947 (*218*).

Distribution.—Estimated area in 1949, 31,998 acres, grown in Washington, Oregon, and Idaho.

CASCADE

Description.—Plant spring habit, midseason, tall; stem white, strong; spike apically awnleted, oblong to fusiform, lax, inclined; glumes glabrous, white, midlong, wide; shoulders midwide, oblique to rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets few, 5 to 15 mm. long; kernels white, short, soft to semihard, ovate; germ midsized; crease midwide, middeep to deep; cheeks rounded; brush midsized, midlong.

Cascade is moderately resistant to stem and leaf rust, to mildew, and also to loose smut and bunt. Its quality is satisfactory for family flour.

History.—Cascade (C. I. 12376) (C. A. N. 3593) (reg. 345) was developed by the Cereal Division, Central Experimental Farm, Ottawa, Ontario, Canada, from the cross [(Quality A-Pacific Bluestem) × C-26–59.2D] × Onas made in 1936 (*81*). The C-26–59.2D was a selection from a Hope × Reward cross. Cascade was licensed in Canada in 1947, distributed in 1948, and is recommended for growing in the eastern Provinces and in British Columbia.

PACIFIC BLUESTEM

Description.—Plant spring habit, late, tall; stem white, midstrong; spike awnleted, linear-oblong, dense, erect to inclined; glumes glabrous, yellowish white, sometimes becoming a light brown, midlong, wide; shoulders wide, square to elevated; beaks wide, obtuse to truncate, 0.5 to 1 mm. long; awnlets several, 8 to 20 mm. long; kernels white, midlong, soft to semihard, ovate, some-

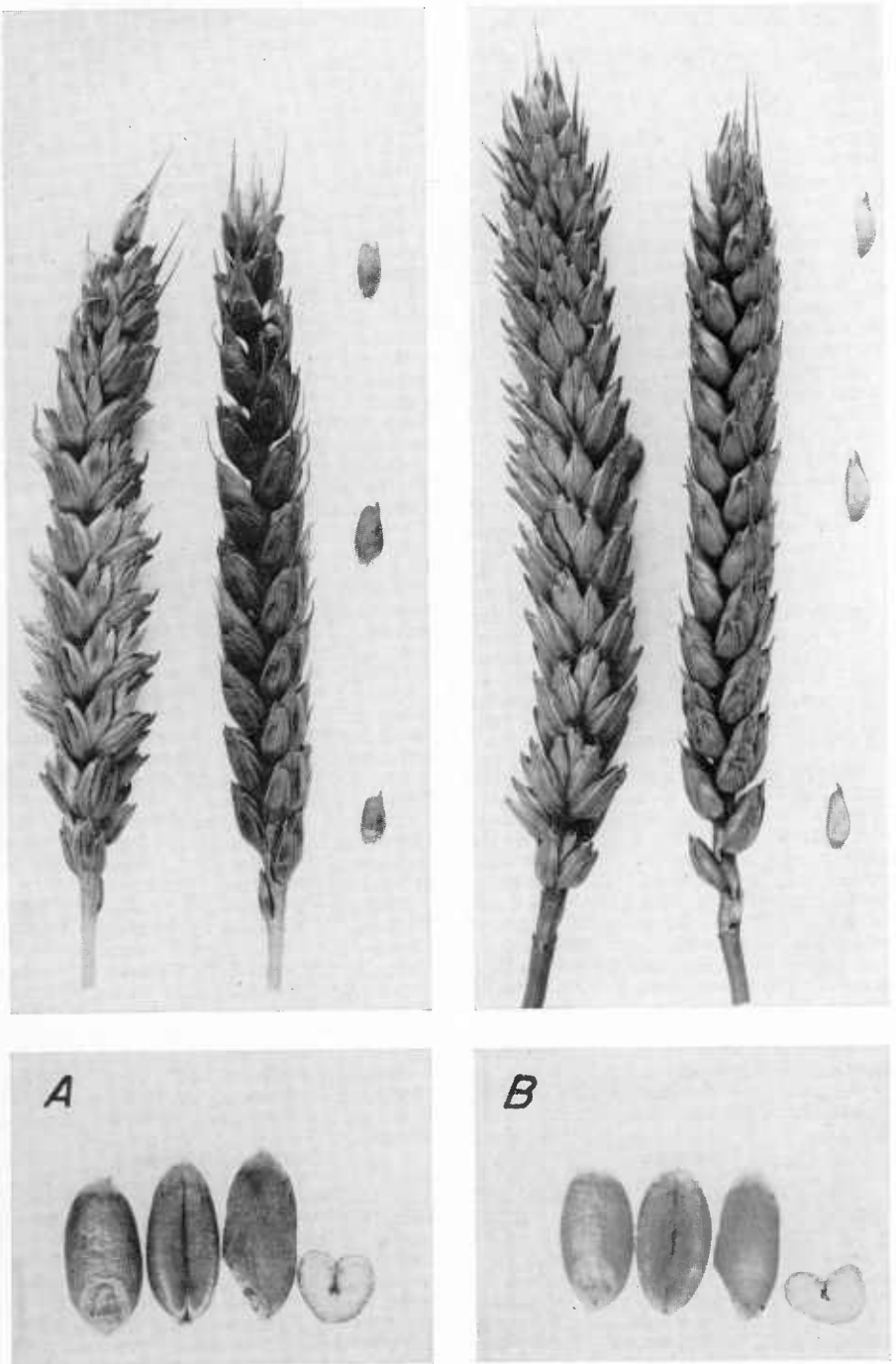

FIGURE 27.—*A*, Pacific Bluestem and *B*, Dicklow wheats: Spikes and glumes, × 1; kernels, × 3.

times becoming oval; germ midsized; crease wide, middeep; cheeks usually angular; brush midsized, midlong. (See fig. 27, *A*.)

This variety can be easily identified by its broad, square to elevated shoulders and broad, blunt beaks

History.—Pacific Bluestem (C. I. 4067) (reg. 16) is an old wheat of the Pacific coast area, most commonly known as Bluestem and White Australian. The variety came to North America from Australia. White Lammas was the leading wheat variety of Australia during the earliest years of wheat production in that country. According to Cobb (*58, p. 9*), White Australian of California is identical with White Lammas. It apparently was introduced into the United States in the early fifties as White Australian or Australian. During the period from 1852 to 1866 (*9, p. 138; 73, p. 586; 190, p. 176*) its culture became established in California under the name White Australian. Bluestem is the name under which the variety became established in Washington and Oregon. According to W. P. Church, of Walla Walla, Wash., the wheat known as Bluestem in the section came from two introductions, the first from Australia in 1882 and the second from New Zealand in 1896. A more complete history is given in Technical Bulletin 459 (*43*).

Distribution.—Estimated area in 1949, 11,007 acres, grown in Washington, Oregon, and Idaho.

Synonyms.—Australian, Bluestem, Palouse Bluestem, White Australian, White Lammas.

PACIFIC BLUESTEM 37

Description.—Pacific Bluestem 37 is very similar to Pacific Bluestem, except in being resistant to some races of bunt.

History.—This strain (C. I. 11903) of Pacific Bluestem is the result of a cooperative program of the California Agricultural Experiment Station and the Division of Cereal Crops and Diseases, at Davis, Calif., to develop strains of the important commercial varieties of California resistant to bunt. The original cross, Martin × Pacific Bluestem, was made in 1922. Bunt-resistant lines were backcrossed to Pacific Bluestem 6 times. Following the sixth backcross a composite of 78 resistant F_3 lines was released for production in the foothill area of the Sacramento Valley and in northern California counties in 1937 (*201*).

Distribution.—Estimated area in 1949, 26,773 acres, grown in California and Nevada.

MAJOR

Description.—Plant spring habit, early to midseason, midtall; stem white, strong; spike apically awnleted, oblong to clavate, dense, erect; glumes glabrous, white, midlong, midwide; shoulders narrow, oblique to elevated; beaks narrow, acute, 0.5 to 1 mm. long; awnlets few, 3 to 5 mm. long; kernels white, midlong, soft, ovate; germ midsized; crease midwide to wide, middeep; cheeks rounded; brush midsized, midlong.

History.—Major (C. I. 4984) was bred at Dookie Agricultural College, Victoria, Australia, from a cross between Federation and Wallace (*166*). It was introduced by the United States Department of Agriculture in 1916 as P. I. 42107 (*211*). The variety was distributed by the Branch Experiment Station at Waterville, Wash., about 1929.

Distribution.—Estimated area in 1949, 1,474 acres, grown in Washington.

OREGON ZIMMERMAN (ZIMMERMAN)

Description.—Plant spring habit, midseason, tall; stem white, strong; spike awnleted, clavate, middense to dense at apex, inclined; glumes glabrous, white, midlong, midwide; shoulders narrow, oblique; beaks midwide, obtuse, 1 mm. long; awnlets several, 5 to 25 mm. long; kernels white, short to midlong, soft; germ elliptical, midsized; crease wide, deep; cheeks angular; brush midlong.

History.—Ed. Zimmerman, of Shedd, Oreg., developed this variety from a single plant and first distributed it about 1921. As the Surprise variety has been grown in this locality, it is probable that Oregon Zimmerman (C. I. 7359) (reg. 281) is a selection from it. Oregon Zimmerman is grown in Oregon under the name "Zimmerman." It has white kernels and should not be confused with the soft red winter variety bearing the latter name.

Distribution.—Estimated area in 1949, 21,309 acres, grown in the Willamette Valley of Oregon.

Synonym.—Zimmerman.

DICKLOW

Description.—Plant spring habit, late, midtall to tall; stem glaucous before maturity, white, midstrong to strong, coarse; leaves broad; spike awnleted, clavate, dense, erect; glumes glabrous, white, midlong, midwide, shoulders midwide, oblique to square; beaks wide, obtuse, 1 mm. long; awnlets several, 3 to 15 mm. long; kernels white, short to midlong, soft, oval to ovate; germ small to midsized; crease wide, deep; cheeks

rounded to angular; brush midsized, midlong. (See fig. 27, *B*.)

Dicklow produces a low-protein, very white soft flour of good quality.

History.—Dicklow (C. I. 3663) (reg. 21) is a selection from Surprise. Its origin has been recorded by Aicher (*6, p. 20*) as follows:

> Mr. James Holly, of Utah County, Utah, obtained some California Club wheat from northern California and seeded it on his farm. Excellent results were obtained, and he called the attention of his neighbor, Mr. Richard Low, to his new wheat. Mr. Low obtained some and grew it. He noticed that the wheat contained different types and proceeded to select the type which he liked best. He grew this selection for several years, and the neighbors soon began clamoring for "Dick" Low's wheat. As the wheat became spread over that section of Utah, it lost its personal connection with "Dick" Low and became known simply as Dicklow wheat.

Irwin Dicklow is the name used for a selection of Dicklow developed by Carl D. Irwin, Twin Falls, Idaho, and is even more uniform than Dicklow itself.

Distribution.—Estimated area in 1949, 29,229 acres, grown in Utah, Idaho, Colorado, Oregon, Nevada, Washington, and Montana.

Synonyms.—Irwin Dicklow, Jim Holly.

FLORENCE (QUALITY)

Description.—Plant spring habit, early, short to midtall; stem white, strong; spike awnleted, fusiform, middense, erect to inclined, easily shattered; glumes glabrous, yellowish white, short, wide; shoulders wide, oblique to square; beaks wide, acute, 0.5 mm. long; awnlets several, 5 to 25 mm. long; kernels white, short to midlong, hard, oval; germ midsized; crease midwide, middeep to deep; cheeks rounded; brush midsized, midlong. (See fig. 28, *A*.)

Florence is resistant to some races of bunt.

History.—Florence (C. I. 4170) (reg. 23) (P. I. 38349) was introduced from Australia in 1914 by the United States Department of Agriculture (*211*) and was tested at experiment stations in the Western States, but results did not warrant its distribution for commercial growing. It was, however, used extensively in the breeding program because of its bunt resistance. This variety under the name "Quality" was distributed by Luther Burbank, of Santa Rosa, Calif., in 1918 (*29*), as one of his productions and was grown in the United States for several years before it was recognized as being identical with the Australian variety Florence. The Pillsbury Flour Mills Co., of Minneapolis, Minn., distributed seed under the name "Quality" or "Burbank's Quality" in North Dakota, South Dakota, and Minnesota in 1923.

Florence was produced by William Farrer, of New South Wales, Australia, as the result of a successful attempt to produce a bunt-resistant variety. The cross was made in 1901 and Florence was reported to have been distributed in 1907. According to Sutton (*203, p. 288*), its pedigree is as follows:

(White Naples [2] × Improved Fife) × (Improved Fife × Eden)

Distribution.—Estimated area in 1949, 5,797 acres, grown in Montana, Idaho, South Dakota, and Oregon.

Synonyms.—Burbank's Quality, Quality.

WHITE FEDERATION

Description.—Plant spring habit, early, short to midtall; stem white, strong; spike awnless, oblong, middense, erect; glumes glabrous, white, short, wide; shoulders wide, square; beaks narrow, acute, 0.5 mm. long; awnlets wanting or nearly so; kernels white, short, hard, ovate, with truncate tip; germ midlarge; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 28, *B*.)

This variety is very similar to Hard Federation, except that it has white instead of brown glumes, and is taller and more uniform in height. The kernels are not quite so hard. It has proved to be a high-yielding wheat in some sections of California, Oregon, and Washington.

History.—White Federation (C. I. 4981) (reg. 25) is a selection from Federation (*139*). The following indicates its origin (*4, p. 664*): "The seed [hard kernels selected from Federation by Mr. J. T. Pridham, from which Hard Federation originated] was propagated, and in 1910 the occurrence of white heads was noticed and from then until 1912 distinctly white heads were common among the brown . . ."

The name "White Federation" has been used for this variety at the Cowra Experiment Farm, New South Wales, Australia, since 1915, when a field of 3 acres was grown (*165*).

It was introduced into the United States by the United States Department of Agriculture (*211*) in 1916 (P. I. 42104) from Victoria, Australia. It was first grown at the Sherman Branch Experiment

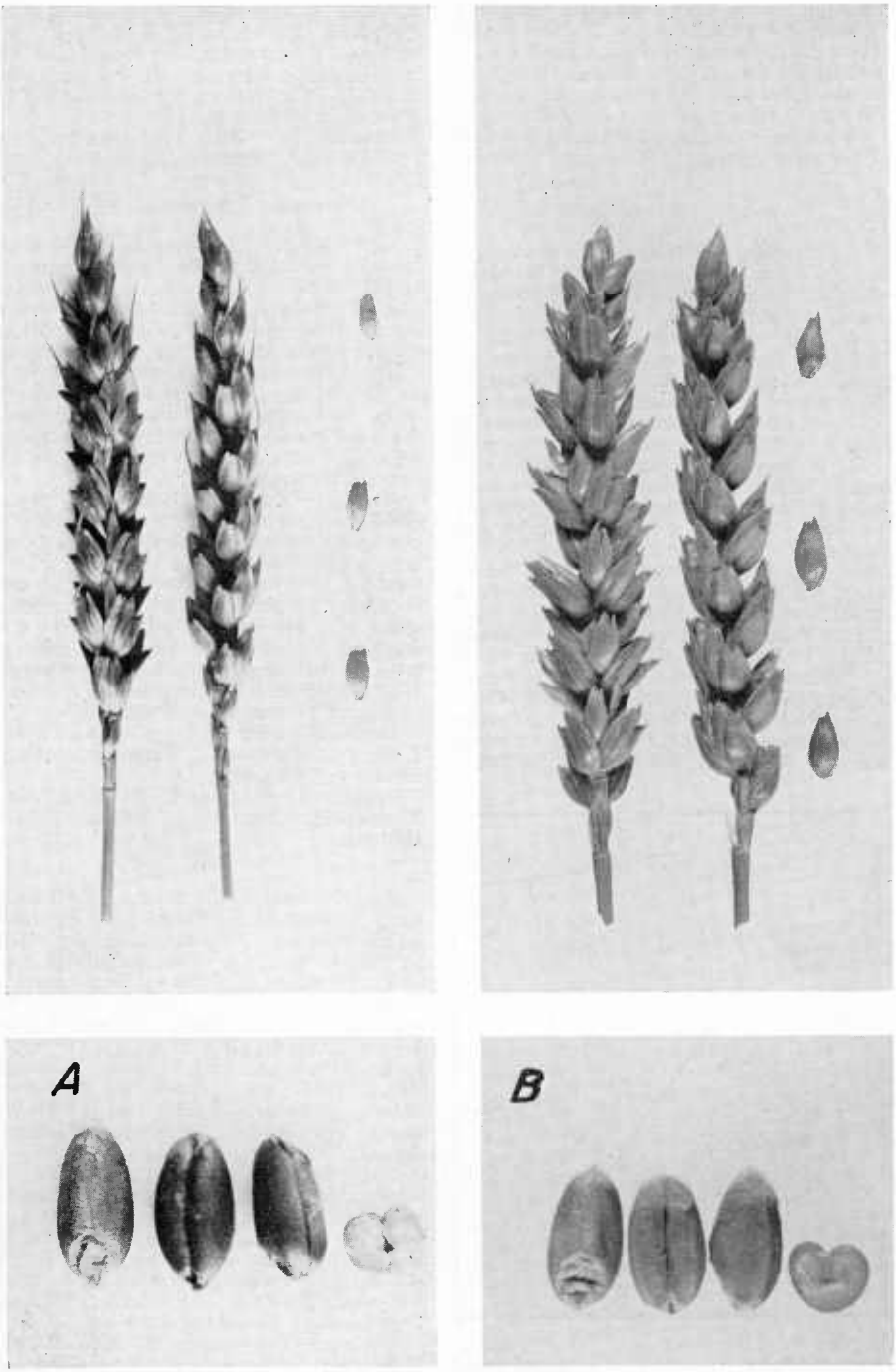

FIGURE 28.—*A*, Florence and *B*, White Federation wheats: Spikes and glumes, × 1; kernels, × 3.

Station, Moro, Oreg., in 1916. In 1918 it was first grown at the United States Plant Introduction Garden, Chico, Calif., and because of its high yield at that point it was increased and distributed in 1920 for commercial growing in California (*56*).

Distribution.—Estimated area in 1949, 5,417 acres, grown in Utah and Nevada.

WHITE FEDERATION 38

Description.—This variety is very similar to White Federation except in being resistant to stem rust and some races of bunt.

History.—This strain (C. I. 11906) of White Federation was developed in cooperative investigations of the California Agricultural Experiment Station and the Division of Cereal Crops and Diseases at Davis, Calif. A program was begun in 1922 to develop, by backcrossing, strains of the important commercial wheat varieties in California that would be resistant to bunt. In 1930 a similar project was begun to add stem rust resistance to the most important varieties. White Federation 38 is the result of backcrossing Martin × White Federation 5 times with White Federation to obtain bunt-resistant White Federation and backcrossing Hope × White Federation 4 times with White Federation to obtain rust-resistant White Federation. Each backcross was made to segregates resistant to bunt or stem rust, depending on the cross. The bunt-resistant and stem-rust-resistant strains were then crossed, and 182 of the F_3 segregates, homozygous for resistance to both diseases, were bulked and increased in 1938. The variety was distributed to growers in the fall of 1939.

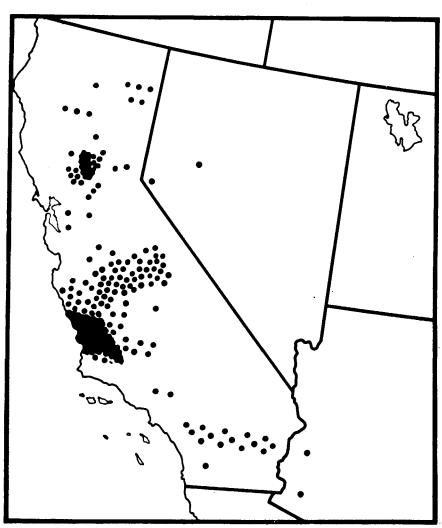

FIGURE 29.—Distribution of White Federation 38 wheat in 1949. Estimated area, 241,675 acres.

Distribution.—Estimated area in 1949, 241,675 acres, grown in three States (fig. 29).

PILCRAW (THOMPSON CLUB)

Description.—Plant spring habit, midseason, midtall; stem white, strong; spike awnleted, clavate, dense, erect; glumes glabrous, white to yellowish, short, wide; shoulders midwide to wide, square to elevated; beaks narrow, acute, 0.5 to 1 mm. long; awnlets several, 8 to 40 mm. long; kernels white, midlong to long, soft, ovate, distinctly humped; germ midsized; crease midwide, middeep to deep, pitted; cheeks rounded; brush large, midlong to long.

History.—Hugh A. Crawford, Napa, Calif., obtained Pilcraw (C. I. 5540) (reg. 29) from a neighbor who said he had noticed an unusual stool of wheat near an unfrequented road and who cut it when ripe and started experimenting with it. Mr. Crawford bought the original seed in 1913 and increased it until in 1917 he had 360 acres growing at Winters, Calif. He distributed it under the name Pilcraw Enormous.

Distribution.—Estimated area in 1949, 2,138 acres, grown in Washington, California, and Oregon.

Synonyms.—Pilcraw Enormous, Thompson, Thompson Club, White Russian.

RICE

Description.—Plant winter habit, very early (except in Northern States), short to midtall; stem white, midstrong; spike awnleted, fusiform, dense, erect; glumes glabrous, white, short to midlong, narrow to midwide; shoulders narrow, oblique to slightly elevated; beaks obtuse, 0.5 to 1 mm. long; awnlets few, 2 to 15 mm. long; kernels pale red, short to midlong, soft, ovate; germ small to midsized; crease midwide, shallow to middeep; cheeks angular; brush midsized, midlong. (See fig. 30, *A*.)

The plants of Rice are pale green as contrasted with the dark green of most varieties. Under some conditions it appears to make a more rapid growth in the spring. It heads about a week earlier than Trumbull at Columbia, Mo., but when grown in the Northern States, they head on about the same date.

History.—The origin of Rice (C. I. 5734) (reg. 30) is undetermined, although it is known to be an old variety in the

FIGURE 30.—*A*, Rice and *B*, Leap wheats: Spikes and glumes, × 1; kernels, × 3.

United States. In 1883, it was first reported as a new variety tested by M. F. P., Mount Pleasant, Ontario County, N. Y. (*157*), and it also was mentioned in that year by C. S. Plumb (*163, p. 310*) in a paper entitled "The Wheats of the World," read at the Batavia Institute.

Rice is very similar if not identical with the variety Zimmerman, which is reported to have been originated about 1837 near Frederick, Md., by Henry Zimmerman, who noticed three heads of singular appearance near the edge of one of his wheatfields (*105*). References in literature show that it was widely grown in Maryland, Virginia, and Pennsylvania about 1850, and that it was an important variety in Kansas in the early nineties. In the South Central States, the name Red May is applied to a variety apparently identical with Rice.

Distribution.—Estimated area in 1949, 11,114 acres, grown in eight Southern States.

Synonyms.—Early May, Early Rice, Little May, May, Red May.

EARLY PREMIUM

Description.—Early Premium is very similar to Rice in all taxonomic characters, although it may be a day or two earlier.

History.—Early Premium (C. I. 11858) was selected from a field of "May" wheat (probably Rice) on the farm of J. A. Houston, Platte County, Mo., in 1924. It was found by the Missouri Agricultural Experiment Station, Columbia, to be about 8 days earlier than such varieties as Fulcaster and was increased and distributed in the fall of 1937 (*75*).

Distribution.—Estimated area in 1949, 1,675 acres, grown in Missouri.

Synonym.—Missouri Early Premium.

LEAP

Description.—Plant winter habit, early, midtall; stem white, midstrong; spike awnleted, fusiform, middense to lax, inclined to nodding, easily shattered; glumes glabrous, yellowish white, midlong, midwide; shoulders midwide, oblique to square; beaks wide, acute, 0.5 mm. long; awnlets few, 3 to 10 mm. long; kernels red, midlong, soft, ovate; germ small; crease midwide to wide, middeep; cheeks usually angular; brush small, midlong. (See fig. 30, *B*.) Leap is resistant to loose smut.

History.—Leap (C. I. 4823) (reg. 35) is reported to have originated from a single plant found in a field of Mediterranean by a son of J. S. Leap, of Virginia. From the five heads gathered in 1901, Mr. Leap increased the wheat until 1905, when he threshed 190 bushels grown from 10 bushels of seed. T. W. Wood & Sons, seedsmen, of Richmond, Va., first distributed the variety as Leap's Prolific. General distribution of the wheat started about 1907, and it later became very popular (*131, p. 44*).

Distribution.—Estimated area in 1949, 127,489 acres, grown in 10 Eastern States, the largest acreage being in Virginia.

Synonyms.—Hastings Prolific, Leap's Prolific, Woods Prolific.

LEAPLAND

Description.—Leapland is similar to Leap in appearance except in having awnlets, several, 5 to 25 mm. long, and in being taller and more uniform. Its growth is more prostrate from spring seeding, but from fall seeding it appears to make a more rapid growth early in the spring and has produced higher yields than Leap in Maryland.

History.—Leapland (C. I. 11762) was the best line developed from 2,000 spaced plants of Leap grown at the Maryland Agricultural Experiment Station, College Park, Md., in 1924. It was distributed to farmers in 1932.

Distribution.—Estimated area in 1949, 48,949 acres, grown in nine Eastern States, the largest acreage being in Maryland.

VAHART

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform, lax to middense, erect; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, midlong, soft to semihard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Vahart is resistant to mosaic, to some races of loose smut, and is somewhat resistant to mildew.

History.—Vahart (C. I. 12537) resulted from a head selected from the original Redhart at the Virginia Agricultural Experiment Station at Blacksburg in 1930 and is similar to that strain of Redhart (*197*). It was released to growers in 1945. It is recommended for growing in all sections of Virginia.

Distribution.—Estimated area in 1949, 60,991 acres, of which 60,805 were grown in Virginia.

KANQUEEN

Description.—Plant winter habit, midseason, midtall; stem white, midstrong

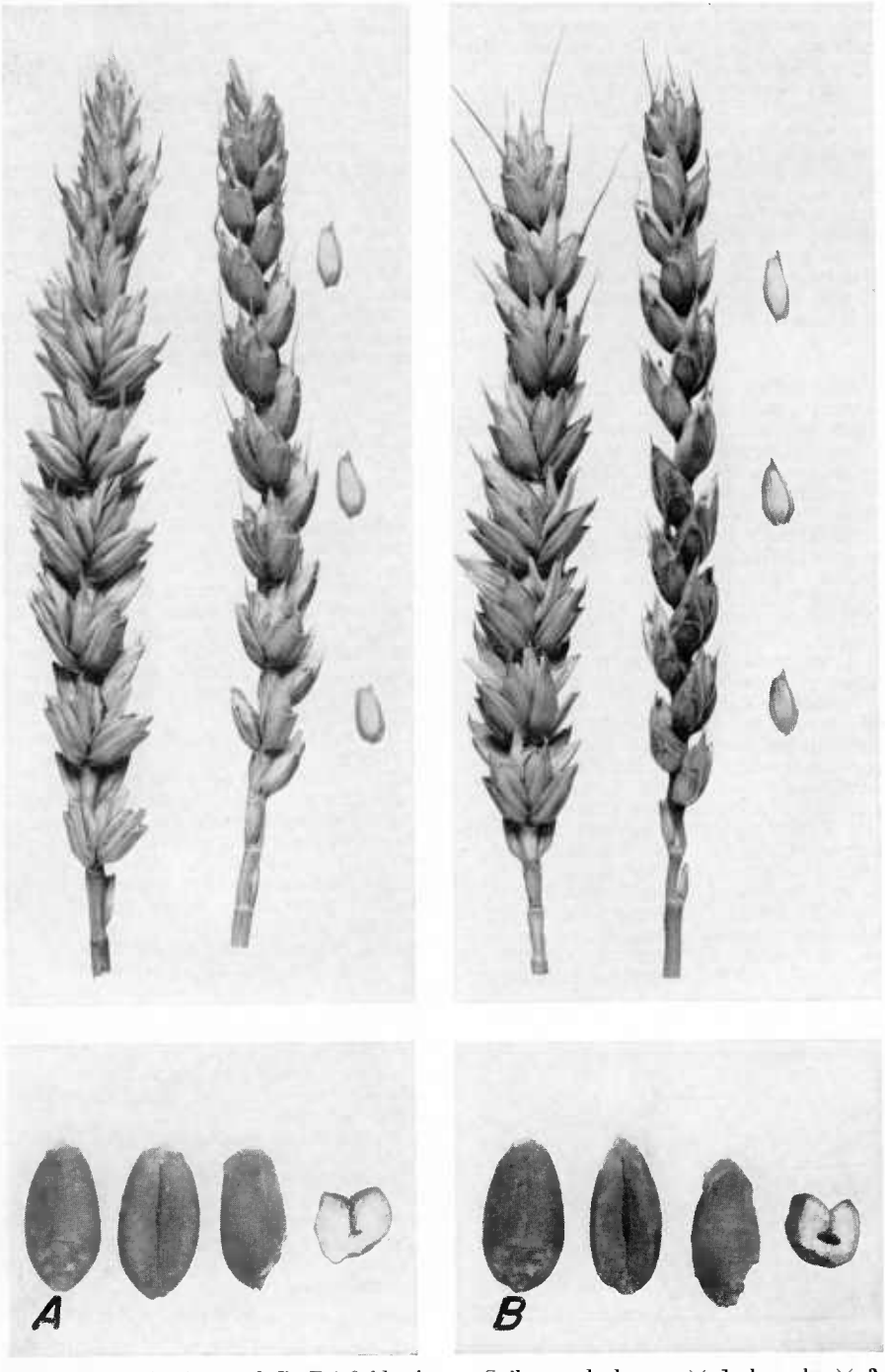

FIGURE 31.—*A*, Vigo and *B*, Fairfield wheats: Spikes and glumes, × 1; kernels, × 3.

to strong; spike apically awnleted, fusiform, middense to dense, inclined; glumes glabrous, white with black stripes, midlong, wide; shoulders wide, oblique to square; beaks midwide, obtuse, 0.5 mm. long; awnlets 3 to 10 mm. long, sometimes incurved; kernels red, midlong, semihard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

History.—Kanqueen (C. I. 12762) was developed by Earl G. Clark, the farmer-wheat breeder of Sedgwick, Kans., and first offered for sale in the fall of 1949. It was sold in small lots in all sections of Kansas.

VIGO

Description.—Plant winter habit, midseason, midtall; stem white, strong; spike awnleted, fusiform, lax, inclined; glumes glabrous, white, long, narrow to midwide; shoulders midwide, square to rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets few, 3 to 15 mm. long; kernels red, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush small, short. (See fig. 31, *A*.)

Vigo is resistant to leaf rust and mosaic and to some races of loose smut. It is of good soft wheat quality and is relatively winter-hardy.

History.—Vigo (C. I. 12220) was developed at the Purdue University Agricultural Experiment Station in experiments cooperative between the Botany Department of that Station and the Division of Cereal Crops and Diseases of the United States Department of Agriculture (*33*). It was selected from a cross between Fultz Sel. C. I. 11512, a sister selection of Wabash, and Trumbull made in 1932. The strain later named Vigo was selected in 1937 and designated as 3241–15. It was distributed in Indiana in the fall of 1946. It is recommended for growing in Indiana, southern Illinois, Ohio, Kentucky, and Missouri.

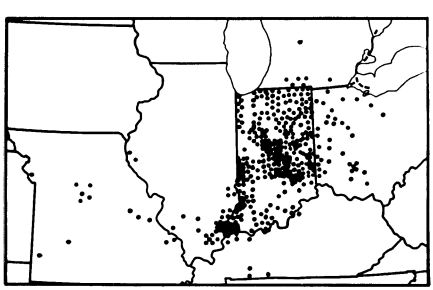

FIGURE 32.—Distribution of Vigo wheat in 1949. Estimated area, 452,427 acres.

Distribution.—Estimated area in 1949, 452,427 acres (fig. 32).

LOFTHOUSE

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders wanting to narrow, oblique; beaks wide, obtuse, 1 mm. long; awnlets several, 5 to 30 mm. long; kernels red, midlong, soft, ovate; germ small; crease midwide, middeep; cheeks usually angular; brush small, midlong.

There is some confusion as to the identity of this variety. It frequently has been referred to as white-kerneled and often is confused with the Kofod variety.

History.—A wheat by the name of Lofthouse has been grown in Utah since about 1890. The sample from which were grown the plants described above was obtained by the Nephi substation, Nephi, Utah, from the State agricultural experiment station at Logan in 1904. The origin of Lofthouse (C. I. 3275) (reg. 32) cannot be traced accurately, and considerable confusion exists as to whether the variety originally was a white-kerneled or red-kerneled wheat. According to J. B. Nelson, the variety became established in Utah from seed distributed by a Mr. Lofthouse, a farmer at Paradise, Utah, about 16 miles south of Logan. Mr. Nelson states that in 1893 or 1894, in a conversation with Mr. Lofthouse regarding the best varieties of wheat for dry farming, he was told that Mr. Lofthouse had received a sample of soft white winter wheat from the United States Department of Agriculture a year or two previously, which promised to produce large yields and was a good milling wheat. The wheat was hardy, standing the winter better than other varieties, and soon became the most extensively grown winter wheat in northern Utah and southern Idaho. Although the above statement shows that the wheat originally was white-kerneled, the wheat grown at Nephi, Utah, since 1904, is red-kerneled.

Distribution.—Estimated area in 1949, 1,705 acres, grown in Idaho.

Synonyms.—Winter La Salle, Winter Nellis. Winter La Salle is thought to be the name under which the wheat later named Lofthouse was sent to Utah by the United States Department of Agriculture.

WABASH

Description.—Plant winter habit, midseason, midtall to tall; stem white, mid-

strong to strong; spike awnleted, fusiform, lax, nodding; glumes glabrous, white, midlong, midwide; shoulders wide, square; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 3 to 10 mm. long; kernels red, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded to angular; brush midsized, midlong.

Wabash is resistant to some races of leaf rust. It is also resistant to mosaic but is susceptible to flag smut and most races of loose smut.

History.—Wabash (C. I. 11384) (reg. 324) was selected from C. I. 5308 in cooperative investigations at the Purdue University Agricultural Experiment Station. C. I. 5308 originated from a single head received by the Division of Cereal Crops and Diseases from the Missouri Agricultural Experiment Station in 1913. This head apparently was from a natural hybrid between Fultz and an unknown variety, as its progeny segregated for leaf-rust resistance, chaff, color, and other characters. A number of leaf-rust-resistant selections were made from it. The one named Wabash was last selected in 1924 and was carried in early tests as C. I. 5308–Wh.–1–1–1. It was approved for distribution in the fall of 1938 by the Indiana and Illinois Agricultural Experiment Stations.

Distribution.—Estimated area in 1949, 22,875 acres, grown in Illinois and Indiana.

FAIRFIELD

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, oblong, lax, erect; glumes glabrous, white, midlong, midwide; shoulders narrow, rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets few, 3 to 20 mm. long; kernels red, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 31, *B*.)

Fairfield is relatively winter-hardy, resistant to mosaic, to many races of loose smut, and has some resistance to leaf rust. It is well adapted for combine harvesting. It has good soft-wheat quality.

History.—Fairfield (C. I. 12013) (reg. 332) was developed from a cross between Purkof and Fulhio made in 1926 by the Agronomy Department of the Purdue University Agricultural Experiment Station, at Lafayette, Ind. The strain later named Fairfield was selected in 1932 and during the testing period was designated as Purdue No. 6 (*64*). It was distributed in Indiana in the fall of 1942.

Distribution.—Estimated area in 1949, 691,488 acres (fig. 33).

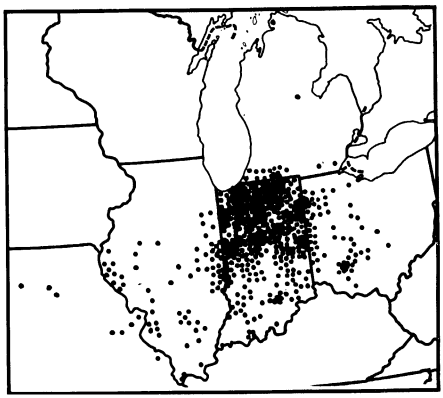

FIGURE 33.—Distribution of Fairfield wheat in 1949. Estimated area, 691,488 acres.

CLARKAN

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, oblong to fusiform, middense, inclined; glumes glabrous, white, sometimes with faint black stripes, midlong, midwide; shoulders midwide to wide, oblique to square; beaks wide, obtuse, 0.5 mm. long; awnlets few, 1 to 8 mm. long; kernels red, midlong, soft, elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, short to midlong. (See fig. 34, *A*.)

Clarkan is moderately resistant to flag smut but is susceptible to mosaic and very susceptible to loose smut and bunt. The grain of Clarkan is of unusually high-test weight. The texture of Clarkan kernels is somewhat harder than that for typical soft wheats.

History.—Clarkan (C. I. 8858) (reg. 316) was developed by a private wheat breeder, Earl G. Clark, of Sedgwick, Kans., from a natural hybrid found in a field of Blackhull in 1916. It probably was a Blackhull × Harvest Queen cross. Clarkan resulted from a plant selected in 1921 and was first known as Clark's No. 40. The variety was tested by the Kansas Agricultural Experiment Station and was distributed by Mr. Clark in 1934, when it was recommended by the Kansas station for growing in eastern Kansas (*101*).

Distribution.—Estimated area in 1949, 939,098 acres (fig. 35).

Synonym.—Clark's No. 40.

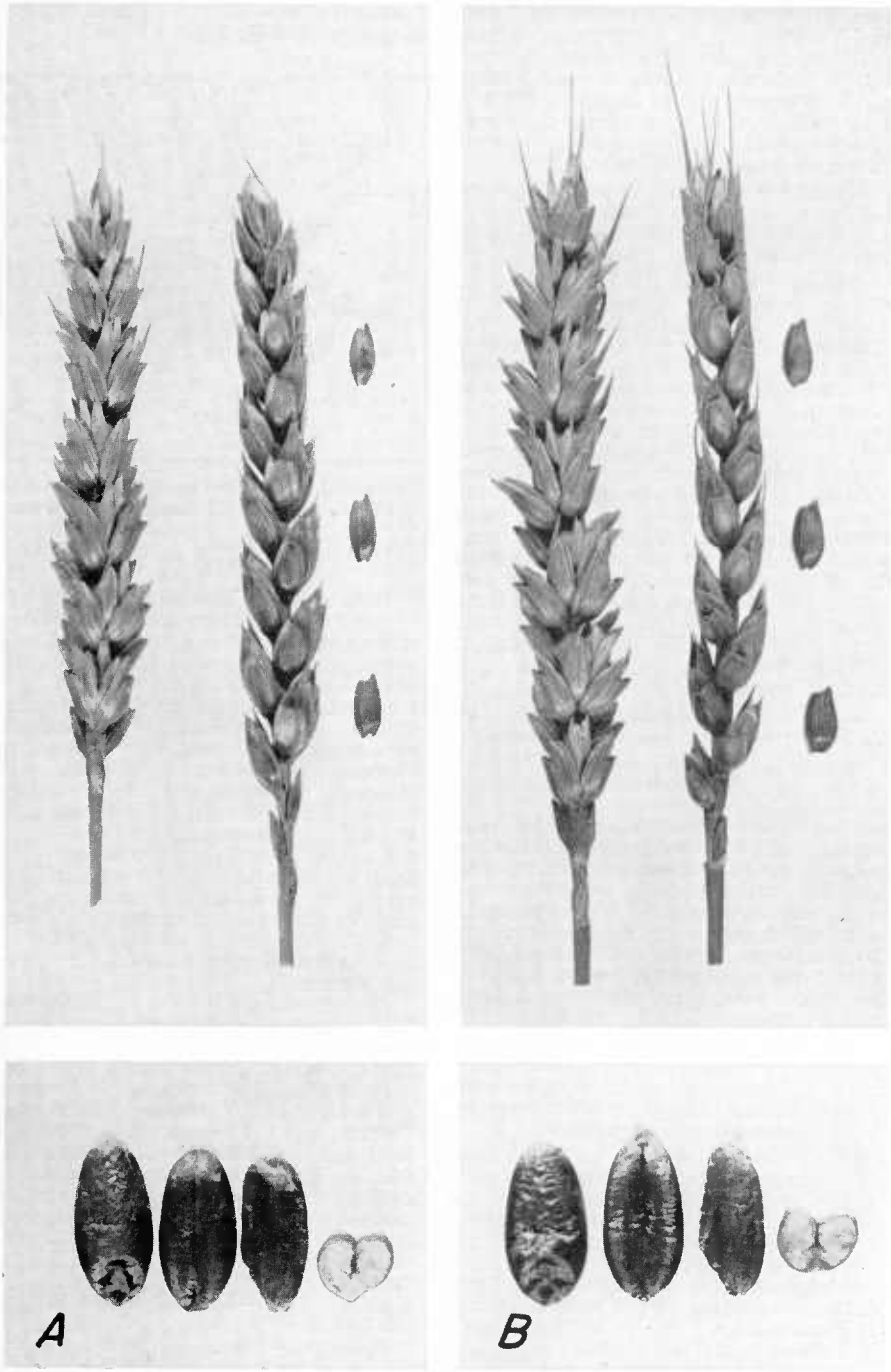

FIGURE 34.—*A*, Clarkan and *B*, Forward wheats: Spikes and glumes, × 1; kernels, × 3.

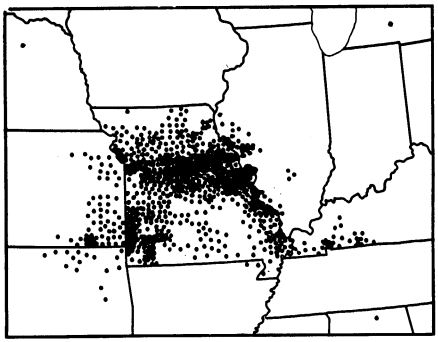

FIGURE 35.—Distribution of Clarkan wheat in 1949. Estimated area, 939,098 acres.

HARVEST QUEEN

Description.—Plant winter habit, midseason, tall; stem white, strong; spike awnleted, oblong, dense, erect to inclined; glumes glabrous, white, midlong, midwide; shoulders wide, oblique to square; beaks wide, obtuse, 0.5 mm. long; awnlets few, 3 to 10 mm. long; kernels dull red, midlong, soft, ovate; germ midsized; crease midwide to wide, middeep; cheeks rounded; brush midsized, midlong.

Harvest Queen is distinct in having tall, bright, strong straw and a thick oblong spike.

History.—The history of Harvest Queen (C. I. 5314) (reg. 39) is not definitely known. The name "Harvest Queen" was used early for a white wheat, but this use apparently has been discontinued. The earlier names, under which the wheat described above was known, were "Black Sea" and "Red Cross." The name "Harvest Queen" is claimed by E. S. Marshall, of De Soto, Kans., to have been applied to the variety by him. He selected a tall, promising stool of the wheat from some other variety in 1895, increased it in 1896, and named it in 1897.

Distribution.—The estimated area of Harvest Queen decreased from 1,007,600 acres in 1919 to 8,665 acres in 1949. The latter acreage was grown in Oklahoma and Missouri.

Synonyms.—Black Sea, Golden Van, Kansas Queen, May Queen, Red Cross, Winter Queen.

PENNOLL

Description.—Plant winter habit, midseason, tall; stem white, midstrong; spike awnleted, oblong, dense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to rounded; beaks wide, obtuse, 0.5 mm. long; awnlets few, 5 to 15 mm. long; kernels red, midlong, soft, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Pennoll is a rather tall growing variety but has withstood lodging very well considering its height. It has been a productive variety in Pennsylvania and has satisfactory soft-wheat quality.

History.—Pennoll (C. I. 12755) was selected from a cross between Valprize and Nittany by the Agronomy Department at the Pennsylvania Agricultural Experiment Station. The selection which resulted in Pennoll was designated as Pa. 114a42 during the testing period. It was entered in the eastern uniform soft winter wheat nursery in the fall of 1949. It was released in 1951 and it was estimated that 30,000 acres were seeded in Pennsylvania in the fall of 1952.

PROSPERITY

Description.—Plant winter habit, midseason, midtall; stem glaucous when green, white, strong, coarse; spike awnleted, linear-oblong, broad, middense, nodding; glumes glabrous, white, midlong, wide; shoulders wide, oblique to square; beaks wide, obtuse, 1 mm. long; awnlets few, 3 to 10 mm. long; kernels red, midlong, soft, ovate; germ midsized; crease wide, deep; cheeks angular; brush midsized, midlong.

This variety is marked by its broad, nodding spike and the very glaucous appearance of the entire plant while immature.

History.—Prosperity (C. I. 5380) (reg. 40) was originated by A. N. Jones, of Newark, Wayne County, N. Y. Mr. Jones first called it No. 8, but later named it American Bronze.[9] It was first advertised and distributed in 1890 by Peter Henderson & Co., seedsmen, of New York City, and was said by them to be the result of a cross between Martin and Fultz (*98*). The name "Prosperity" came into use for the variety about 1895 (*3*).

Distribution.—Estimated area in 1949, 3,038 acres, grown in Illinois.

Synonym.—American Bronze.

FORWARD

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, oblong-fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders oblique to square; beaks wide, obtuse, 0.2 mm. long; awnlets few, 5 to 15 mm. long,

[9] Printed letterheads of Mr. Jones.

sometimes incurved; kernels red, midlong, soft, elliptical; germ midsized; crease midwide, deep; cheeks angular; brush midsized, midlong. (See fig. 34, *B*.)

Forward differs from Prosperity in being earlier and in having shorter beaks and longer awnlets, sometimes incurved. It is resistant to several races of loose smut.

History.—Forward (C. I. 6691) (reg. 41) was originated by the Department of Plant Breeding of the Cornell University Agricultural Experiment Station, Ithaca, N. Y., in cooperation with the Division of Cereal Crops and Diseases. During the experimental stages it was known as Cornell Selection 123–32. Concerning the variety, Doctor Love, who was in charge of the cooperative experiments at Cornell, wrote as follows: [10]

> The Forward is a white chaff, beardless, red-kerneled wheat selected out of a commercial lot of Fulcaster and under test has proved to be winter hardy and a good yielder. It has outyielded Fulcaster and bids fair to be one of our best red-kerneled sorts.

Forward is very different from Fulcaster from which it was selected and may have been a mixture or the result of a natural cross. It was first distributed for commercial growing in New York in the fall of 1920.

Distribution.—The estimated area in 1949, 140,303 acres, grown in 16 Eastern States.

VALPRIZE

Description.—Plant winter habit, midseason, midtall; stem white and purple, strong; spike awnleted, clavate, dense, erect; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to rounded, keels tend to incurve; beaks wide, obtuse, 0.5 to 1 mm. long; awnlets few, 3 to 12 mm. long; kernels light red, midlong, soft, elliptical, broad and somewhat flattened; germ large; crease wide, deep; cheeks angular; brush midsized, midlong.

History.—Valprize (C. I. 11539) is a selection from a cross between Valley and Grandprize made in 1912. The final selection was made in 1920. It was developed by the Cornell University Agricultural Experiment Station at Ithaca, N. Y., in cooperation with the Division of Cereal Crops and Diseases. Valprize was distributed to growers in 1931.

[10] Correspondence of the Division of Cereal Crops and Diseases, dated March 19, 1921.

Distribution.—Estimated area in 1949, 918 acres, grown in Ohio.

RED RUSSIAN

Description.—Plant winter habit, very late, tall; stem white, coarse, strong; spike awnleted, clavate, dense, erect to inclined; glumes glabrous, white, midlong, wide; shoulders midwide, oblique to square; keel incurved above; beaks wide, obtuse, 1 mm. long; awnlets few, 1 to 10 mm. long; kernels red, midlong, soft, ovate, sometimes broadly ovate; germ small to midsized; crease wide, deep; cheeks usually rounded; brush midsized, midlong to long.

History.—Red Russian (C. I. 4509) (reg. 43) undoubtedly is of English origin and is, or is derived from, the old Squarehead wheat. The origin of the variety, however, is undetermined. The name "Red Russian" seems to be used for the variety only in the Pacific Northwest section of the United States. The variety was introduced into the Palouse section of Washington about 1890 and has always been best known there under the name "Red Russian" (*84*). Because of lack of winter hardiness, susceptibility to bunt, and poor grain quality, the acreage of Red Russian is decreasing.

Distribution.—The estimated area of Red Russian decreased from 154,900 acres in 1919 to 9,139 acres in 1949. The latter acreage was in Idaho, Washington, and Oregon.

Synonyms.—German Red, Montana Deal, Red Walla, Squarehead.

NURED

Description.—Plant winter habit, midseason, midtall; stem purple, midstrong; spike awnleted, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders narrow, rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm.; kernels red, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, short.

Nured is resistant to mosaic and to some races of loose smut. It is moderately resistant to mildew.

History.—Nured (C. I. 12455) was developed from a cross between Forward and a selection from Dietz, which is a synonym for Fulcaster, at the Cornell University Agricultural Experiment Station, at Ithaca, N. Y., in investigations cooperative with the Division of Cereal Crops and Diseases. It was distributed in 1939 as a high-yielding variety in those areas of New York where a feed wheat was desired (*137*).

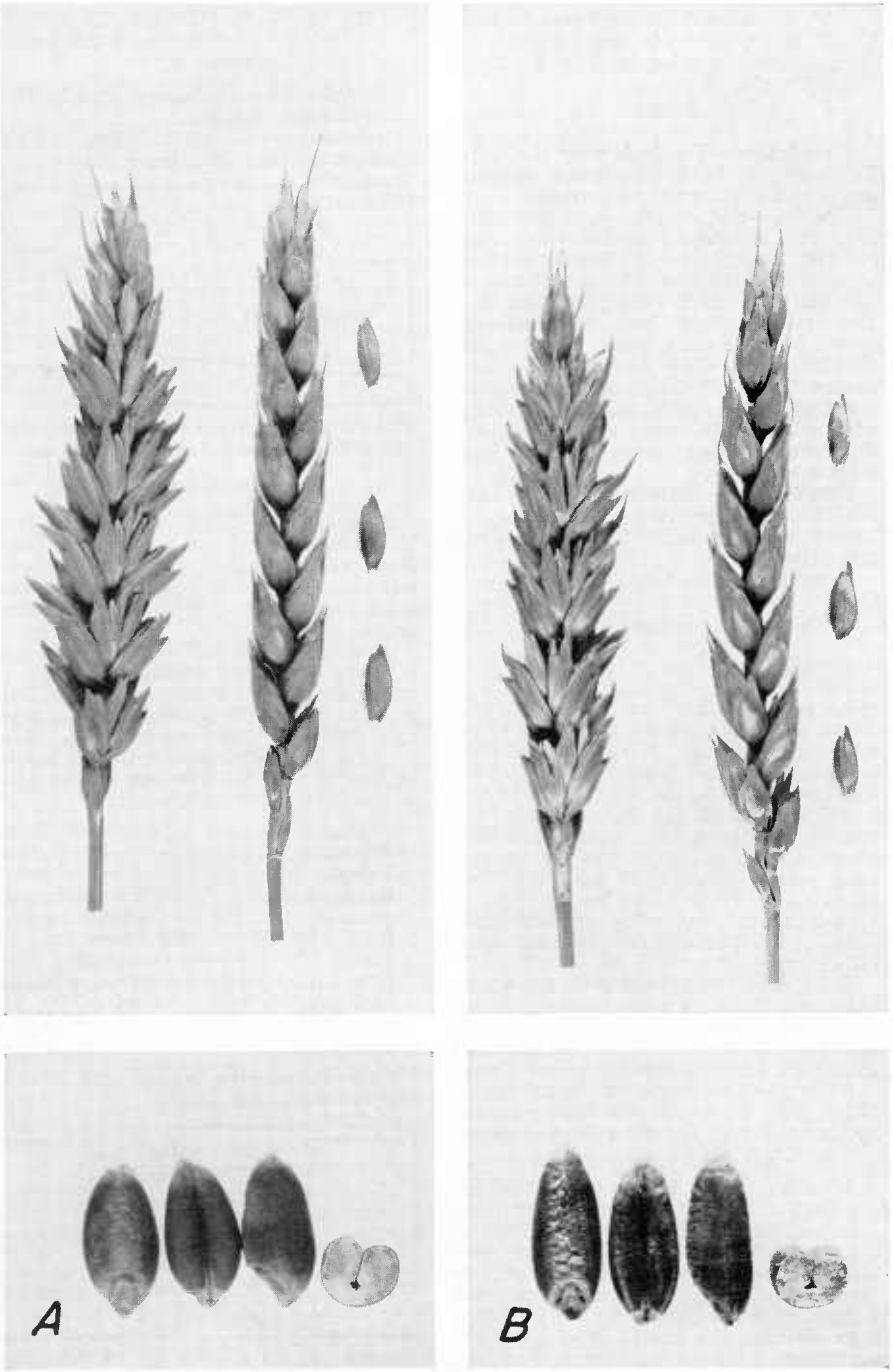

FIGURE 36.—*A*, Fultz and *B*, Redhart wheats: Spikes and glumes, × 1; kernels, × 3.

Distribution.—Estimated area in 1949, 19,257 acres, grown in seven States, the largest acreages being in New York and Pennsylvania.

FULHIO

Description.—Fulhio is very similar to Fultz except in having more fusiform heads and slightly longer kernels.

History.—Fulhio (C. I. 6999) (reg. 231) was developed at the Ohio Agricultural Experiment Station (*205*) from a plant selected from Fultz. The selection was made at Wooster, Ohio, in 1912. The variety has been commercially grown in Ohio since 1920. It was first distributed as Ohio No. 127 and later named "Fulhio." Its superior characters are high yield, good tillering capacity, winter hardiness, fairly stiff straw, and somewhat greater resistance to loose smut than Fultz.

Distribution.—Estimated area in 1949, 178,212 acres, grown in six States, the largest acreages being in Illinois, Ohio, and Missouri.

Synonym.—Ohio No. 127.

FULTZ

Description.—Plant winter habit, midseason, midtall; stem purple, midstrong; spike awnleted, fusiform to oblong, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to square; beaks narrow to midwide, obtuse, 0.5 mm. long; awnlets few, 3 to 15 mm. long; kernels pale red, usually short, ovate; germ midsized; crease usually midwide, shallow to middeep; cheeks rounded to angular; brush midsized, midlong. (See fig. 36, *A*.)

It is almost impossible to distinguish Fulhio, Trumbull, and Ashland from Fultz.

Fultz does not appear pure for winter habit of growth, as some plants in it will head from early spring seeding, while selections from it, such as Ashland and Trumbull, are uniform for winter habit.

History.—The origin of Fultz (C. I. 1923) (reg. 48) wheat has been recorded by Carleton (*37, pp. 199–200*), as follows:

> In 1862, in Mifflin County, Pa., Abraham Fultz, while passing through a field of Lancaster wheat, which is an awned variety, found three spikes of awnless wheat. He sowed the seed from these spikes the same year, and continued sowing a larger amount each year, until he obtained sufficient seed to distribute it pretty well over the country. It soon became a well-marked and popular variety, called Fultz from the name of the breeder. * * * In 1871 the United States Department of Agriculture distributed 200 bushels of the wheat for seed.

Distribution.—Estimated area in 1949, 377,243 acres (fig. 37).

Synonyms.—Bluestem, Bluestem Fultz, Hickman, Posey, Slickhead, Snow.

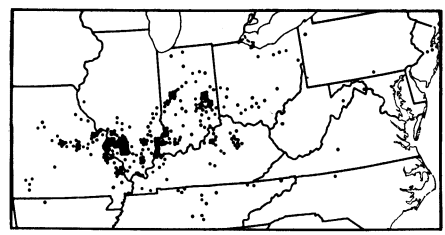

FIGURE 37.—Distribution of Fultz wheat in 1949. Estimated area, 377,243 acres.

TRUMBULL

Description.—Trumbull differs from Fultz in being pure for winter habit. It is slightly taller and later and has slightly stronger and less purple stems. It is resistant to several races of loose smut.

History.—Trumbull (C. I. 5657) (reg. 50) was developed at the Ohio Agricultural Experiment Station, Wooster, from a plant selected from Fultz. The selection was grown as early as 1908. After 8 years of experiments with the variety at Wooster, C. G. Williams (*229, p. 466*) wrote as follows regarding it:

> The other new introduction is the Trumbull, a pure-line selection of the Fultz. Wherever the Fultz wheat is found satisfactory, the Trumbull should succeed. It may be expected to yield 2 to 4 bushels per acre more than the Fultz. It possesses the quality of all pure lines—greater uniformity than the bulk seed, is fair in breadmaking and among the good ones in stiffness of straw.

Distribution.—Estimated area in 1949, 300,954 acres (fig. 38).

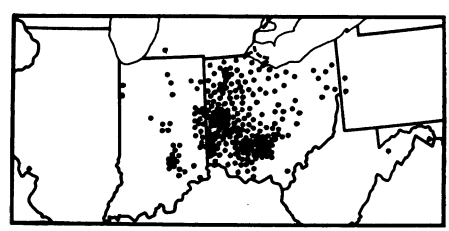

FIGURE 38.—Distribution of Trumbull wheat in 1949. Estimated area, 300,954 acres.

ASHLAND

Description.—According to the Kentucky Agricultural Experiment Station (*5, p. 1197*), Ashland is very similar in character to ordinary Fultz. It has the good milling qualities of Fultz, and in addition yields better, with better straw, and is fairly resistant to scab and other diseases.

History.—Ashland (C. I. 6692) (reg. 49) was developed from a plant selected from Fultz at the Kentucky Agricultural Experiment Station, Lexington, Ky., and was distributed to farmers in 1919 and 1920.

Distribution.—Estimated area in 1949, 128 acres, grown in West Virginia.

FULTZO-MEDITERRANEAN

Description.—Plant winter habit, midseason, midtall; stem purple, strong; spike awnleted, clavate, dense, erect, easily shattered; glumes glabrous, white, midlong, midwide; shoulders wanting to narrow, oblique; beaks wide, obtuse, 1 mm. long; awnlets several, 1 to 10 mm. long; kernels red, short to midlong, soft, ovate; germ midsized; crease narrow to midwide, shallow to middeep; cheeks usually rounded; brush midsized, midlong.

Fultzo-Mediterranean is distinct from Fultz in having very strong stems and erect, dense, clavate spikes.

History.—The origin of Fultzo-Mediterranean (C. I. 4811) (reg. 51) is not definitely known. Many synonyms are used for the variety, one of which may be the original name. The variety was first distributed as Fultzo-Mediterranean by Everitt's O. K. Seed Store, Indianapolis, Ind., in 1898. The variety was evidently named by that firm, and it is claimed by them to have originated from a cross between Fultz and Mediterranean (*76*).

Fultzo-Mediterranean shows no indication of having been derived from Mediterranean, although it has many of the characters of Fultz.

Distribution.—Estimated area in 1949, 2,010 acres, grown in Missouri.

Synonyms.—Columbia, Flat Top, New Columbia, Square Head.

CARALA

Description.—Carala is very similar to Purplestraw, except in having stronger white stems and in giving higher yields. It is adapted for growing in the same areas as Purplestraw.

History.—Carala (C. I. 12184) was selected from Alabama Bluestem, a strain of the Purplestraw variety, by the North Carolina Agricultural Experiment Station at Raleigh, in 1929 and was designated as Alabama Bluestem 89 in early tests. It was distributed to farmers in the fall of 1940.

Distribution.—Estimated area in 1949, 71,894 acres, grown in 12 Southeastern States.

Synonym.—Alabama Bluestem 89.

REDHART

Description.—Plant spring intermediate habit, early to midseason, midtall; stem white, strong; spike awnleted, fusiform, middense, erect to inclined; glumes glabrous, white, midlong to long, narrow to midwide; shoulders narrow, wanting to oblique; beaks narrow, obtuse, 1 mm. long; awnlets several, 5 to 20 mm. long; kernels red, midlong, semihard, elliptical; germ midsized; crease midwide, deep; cheeks angular; brush midsized, midlong. (See fig. 36, *B.*)

History.—Redhart (C. I. 8898) (reg. 283) was selected from the southern Flint or Red May wheat by Coker's Pedigreed Seed Co., Hartsville, S. C. It was first distributed in 1921. Redhart 3 (C. I. 11860) was developed from a cross between Redhart and a variety named Golden Chaff. Redhart 3, Redhart 4 (C. I. 12003), and Redhart 5 (C. I. 12004) are reselections of the same line and are earlier than the original Redhart.

Distribution.—Estimated area in 1949, 604,624 acres, grown in 12 States (fig. 39).

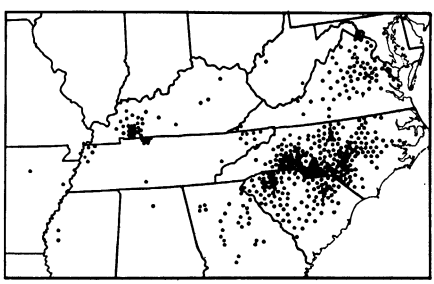

FIGURE 39.—Distribution of Redhart wheat in 1949. Estimated area, 604,624 acres.

TAYLOR

Description.—Plant spring intermediate habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, midlong, soft, elliptical; germ midsized; crease midwide,

middeep; cheeks angular; brush midsized, midlong.

Taylor is resistant to leaf rust, moderately resistant to stem rust and mosaic, and has yielded very well in the South. It is susceptible to mildew and is not sufficiently winter-hardy for growing north of Virginia and Maryland. It has soft grain of good quality, although it averages somewhat higher in protein content than the older varieties grown in the South. It is lower in protein content than the Atlas strains.

History.—Taylor (C. I. 12461) was developed from the cross Trumbull × Frondoso made at Arlington Farm, Rosslyn, Va., by the Division of Cereal Crops and Diseases. Selection was continued at Beltsville, Md., where it was designated Y2375. It was entered in the Uniform Southern Wheat Nursery in 1946 and its adaptation and value determined cooperatively with the agricultural experiment stations in the South. It was distributed by the South Carolina and North Carolina Agricultural Experiment Stations in the fall of 1953.

HARDIRED

Description.—Plant intermediate habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform to oblong, middense, inclined; glumes glabrous, white, long, narrow; shoulders wanting to narrow, oblique; beaks midwide, obtuse, 1 mm. long; awnlets several, 5 to 20 mm. long; kernels red, midlong, semihard, elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Hardired is moderately resistant to leaf rust and to some races of mildew.

History.—Hardired 5 (C. I. 12411) was developed by the Coker's Pedigreed Seed Co., Hartsville, S. C., from a cross between Early Red May and a selection from Hope × Hussar made in 1932, by the Division of Cereal Crops and Diseases at Manhattan, Kans. The first distribution was designated as Coker 39–3 until it was named and distributed in the fall of 1940.

Several similar strains have since been distributed.

Distribution.—Estimated area in 1949, 109,903 acres, grown in nine Southern States, the largest acreage being in North Carolina and South Carolina.

COKER 47–27

Description.—Plant spring intermediate habit, midseason, midtall; stem white, strong; spike awnleted, oblong, middense to dense, erect; glumes glabrous, white, midlong, midwide; shoulders narrow to wanting; beaks midwide, obtuse, 0.5 mm. long; awnlets few, 5 to 10 mm. long; kernels red, midlong, soft to semihard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Coker 47–27 is resistant to leaf rust and moderately resistant to stem rust. It is about 2 days later than Hardired and is somewhat more winter-hardy than Coastal.

History.—Coker 47–27 (C. I. 12563) was selected at the Coker's Pedigreed Seed Co. at Hartsville, S. C., from a cross between Fronteira and Hardired made in 1939. After several years of selection and testing, it was offered for sale in the fall of 1950.

ATLAS 66

Description.—Plant spring intermediate habit, midseason, short to midtall; stem white, strong; spike awnleted, oblong to clavate, dense, erect; glumes glabrous, white, midlong, midwide; shoulders narrow, wanting to rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 3 to 10 mm. long; kernels red, midlong, soft, elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 40, *A*.)

Atlas 66 is resistant to leaf and stem rust and has mild resistance to powdery mildew. It has stiff straw and is similar to Leap in time of maturity, or about a week later than Purplestraw. It is recommended for growing on the Coastal Plain and Piedmont sections of North Carolina, but does not have sufficient winter hardiness for growing in the mountain areas. The grain of Atlas averages higher in protein content than most varieties.

History.—Atlas 66 (C. I. 12561) was developed cooperatively by the North Carolina Agricultural Experiment Station and the Division of Cereal Crops and Diseases. Segregating F_4 lines from a cross between Frondoso and a selection from a cross between Redhart 3 and Noll 28 were sent from the Division of Cereal Crops and Diseases, Arlington Farm, Va., to Raleigh, N. C., in 1940. Noll 28 was selected at State College, Pa., from a cross between Hussar and Forward. Atlas 66 resulted from a selection made in North Carolina. It was tested widely as N. C. 5466 in the uniform nursery in the Southern States, beginning in 1948. It was distributed in North Carolina in the fall of 1948 (*143*).

Distribution.—Estimated area in 1949, 1,535 acres, grown in North Carolina.

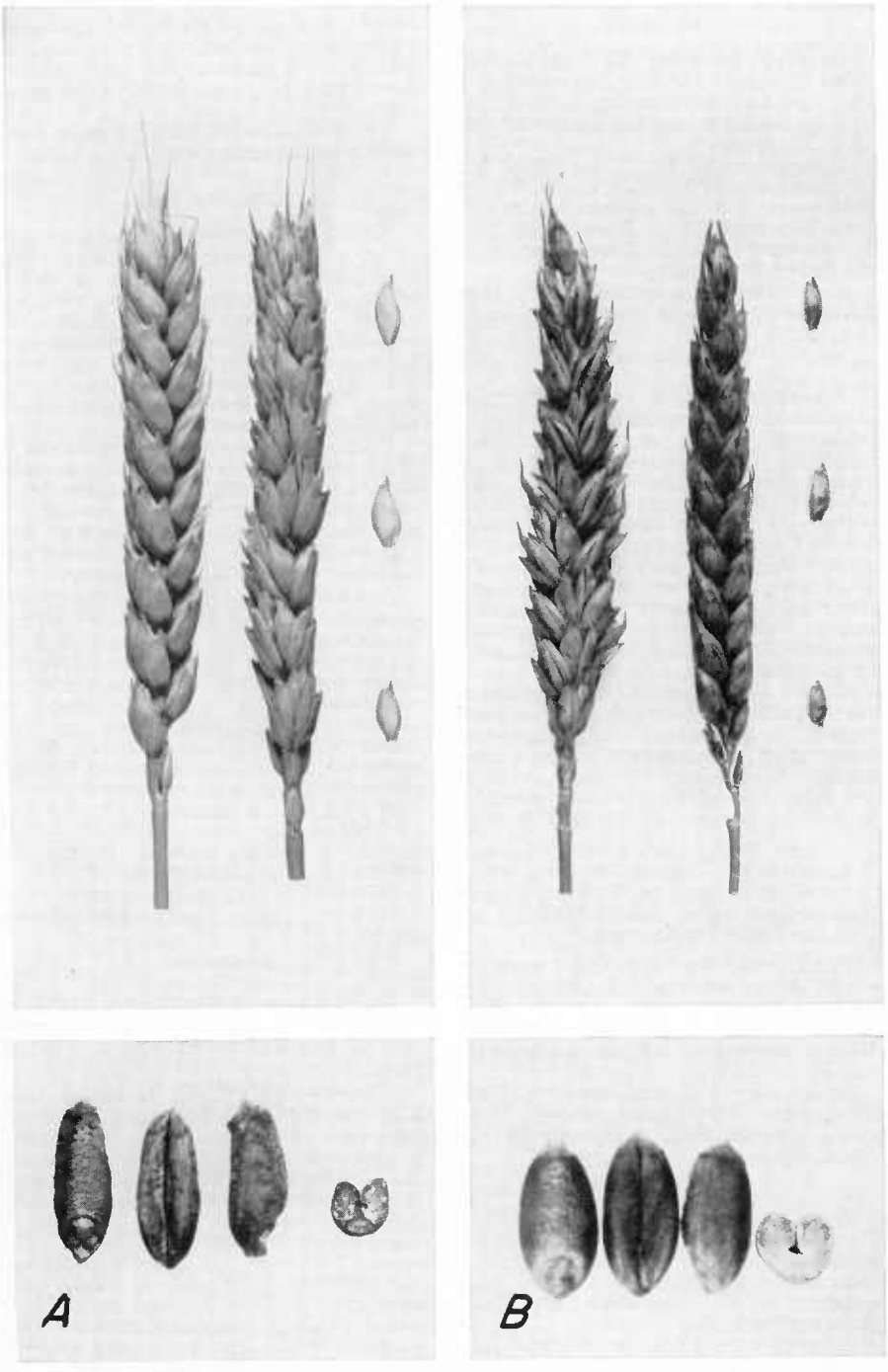

FIGURE 40.—*A*, Atlas 66 and *B*, Purplestraw wheats: Spikes and glumes, × 1; kernels, × 3.

ATLAS 50

Description.—Atlas 50 is similar to Atlas 66 except in being less resistant to leaf rust and more resistant to mildew and in having somewhat longer awnlets (5 to 20 mm.).

History.—Atlas 50 (C. I. 12534) is a sister selection of Atlas 66, and its history is the same. It was entered in the Uniform Southern Wheat Nursery in 1947. It was distributed in North Carolina in the fall of 1948 (*143*).

Distribution.—Estimated area in 1949, 1,841 acres, grown in North Carolina.

PURPLESTRAW

Description.—Plant spring intermediate habit, early, midtall; stem purple; midstrong; spike awnleted, fusiform, middense, inclined to nodding; glumes glabrous, white, short to midlong, midwide; shoulders narrow to midwide, oblique to square; beaks wide, obtuse, 0.5 to 1 mm. long; awnlets several, 3 to 10 mm. long; kernels red, short to midlong, soft, ovate or sometimes nearly oval; germ midsized; crease midwide, shallow to middeep; cheeks usually rounded; brush small to midsized, midlong. (See fig. 40, *B*.)

History.—The origin of Purplestraw (C. I. 1915) (reg. 53) wheat is undetermined. It is, however, one of the earlier varieties of wheat grown in the United States. Concerning its early culture, the following information was recorded in 1851 by Edmund Ruffin (*173, p. 454*):

> From 1822 to the present time the same kind of wheat has been cultivated, first known as Mountain Purplestraw and more lately distinguished as the Early Purplestraw.

Purplestraw has been an important wheat in the southeastern United States for more than 125 years.

Distribution.—Estimated area in 1949, 100,692 acres, grown in 11 Southeastern States.

Synonyms.—Alabama Bluestem, Bluestem, Early Purplestraw, Georgia Bluestem, Georgia Red, Mountain Purplestraw, Ripley.

GASTA

Description.—Gasta is similar to Purplestraw except in being later and having a more winter habit of growth. It is a higher yielding wheat and more resistant to loose smut than Purplestraw at Experiment, Ga.

History.—According to Bledsoe (*21*), Gasta (C. I. 11398) (reg. 268) was developed from a head selected from Purplestraw at the Georgia Agricultural Experiment Station, Experiment. The selection was made in 1921 and was first distributed for commercial growing in 1931.

Distribution.—Estimated area in 1949, 689 acres, grown in Georgia.

CHANCELLOR

Description.—Plant intermediate habit, early, midtall; stem purple, strong; spike awnleted, fusiform, middense to dense, erect; glumes glabrous, white, midlong, narrow; shoulders narrow, wanting to rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets few, 3 to 25 mm. long; kernels red, midlong, soft, ovate; germ small; crease midwide, middeep; cheeks rounded; brush small, short.

Chancellor is similar to Purplestraw in plant characters except that it is more winterish in habit of growth. It is moderately resistant to leaf rust and is resistant to mosaic, but it is very susceptible to mildew. It has yielded significantly higher than Purplestraw.

History.—Chancellor (C. I. 12333) was developed at the Georgia Agricultural Experiment Station at Experiment, in cooperation with the Division of Cereal Crops and Diseases, by crossing a selection from (Carina × Mediterranean) × (Dietz × Carina) with a selection from P1068 × Purplestraw[3]. Carina, Mediterranean, and P1068a, a sister of Kanred, are resistant to some races of leaf rust. The strain later named Chancellor was designated as No. H1050–12–5–10–3 during the testing period. It was distributed in Georgia in the fall of 1947.

Distribution.—Estimated area in 1949, 9,941 acres, grown in seven Southeastern States.

SANFORD

Description.—Sanford is very similar to Purplestraw in plant and kernel characteristics but is somewhat resistant to leaf rust.

History.—Sanford (C. I. 12026) (reg. 336) was developed in cooperative investigations of the Georgia Agricultural Experiment Station at Experiment, and the Division of Cereal Crops and Diseases. It is the result of backcrossing leaf-rust-resistant selections from Kanred × Purplestraw to Purplestraw twice. The second backcross was made in 1928, and the selections were made in 1934. Two selections, H264–1–2–3–3–3 and H264–1–2–3–3–5, which appeared to be identical in plant characters, yield, and quality, were bulked and increased in 1940. The variety was named "Sanford" and dis-

tributed to Georgia farmers in the fall of 1940.

Sanett, a selected Sanford, was distributed by the Marrett Seed Farm of Westminster, S. C.

Distribution.—Estimated area in 1949, 164,871 acres, grown in Georgia and seven other Southeastern States.

Synonym.—Sanett.

FLINT (RED MAY)

Description.—Plant winter intermediate habit, early to midseason, midtall; stem purple, midstrong; spike awnleted, oblong, dense, erect; glumes glabrous, white, midlong, midwide; shoulders narrow, oblique to square; beaks midwide, obtuse, 0.5 to 1 mm. long; awnlets few, 2 to 40 mm. long; kernels pale red, short to midlong, soft, ovate; germ small; crease midwide, middeep; cheeks angular to rounded; brush midsized, midlong.

History.—The origin of Flint (C. I. 6307) (reg. 47) wheat is undetermined. It is known to be an old wheat of the eastern United States. The early names for the variety and the literature concerning them are very confusing. A White Flint, claimed to have been introduced from Spain in 1814 (*92, p. 217*), which became widely grown in the Eastern States from 1830 to 1850, was described by Harmon as awnless, with white glumes and hard white kernels. There seems to be no winter wheat of that description now grown. The Flint wheat now in cultivation has red kernels and is similar to wheat known as Little Red May, Early May, and Rappahannock. These are all old names in American wheat literature. Little Red May is listed by Killebrew (*123, p. 56*) as a variety of the above description which "was brought into Tennessee by Joseph Jacobs from Missouri, no doubt having been taken there from Kentucky or Virginia."

Much of the Flint wheat now grown is known as Red May or Little Red.

Distribution.—Estimated area in 1949, 64,518 acres, grown in 10 Southeastern States.

Synonyms.—Early May, Little May, Little Red, Little Red May, May, Rappahannock, Red May.

COASTAL

Description.—Plant spring habit, midseason, midtall to tall; stem white, midstrong; spike awnleted, fusiform, middense, inclined; glumes glabrous, white, midlong; beaks 0.5 mm. long; kernels red, midlong, soft, elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Coastal is resistant to leaf and stem rust and has some resistance or tolerance to mildew and septoria glume blotch. It is susceptible to mosaic. Coastal has a spring growth habit and is not winterhardy. It is about 1 week later than Hardired. It is recommended only for the Coastal Plain of the Southeast. Grain of Coastal averages higher in protein content than most varieties except Atlas.

History.—Coastal (C. I. 12463) was selected from a cross between Frondoso and a selection from a cross between Redhart 3 and Noll 28 at the Coker's Pedigreed Seed Co., Hartsville, S. C. The crosses were made by the Division of Cereal Crops and Diseases at Arlington Farm, Va., and F_4 segregating material was furnished to cooperators in the fall of 1940. Noll 28 was a selection from a cross between Hussar and Forward made at State College, Pa. During the period of testing Coastal was designated as Cokers 45–21. It was released in the fall of 1949.

HUSTON

Description.—Plant spring habit, early to midseason, midtall; stem faintly purple, midstrong; spike awnleted, oblong, dense, erect, easily shattered; glumes glabrous, white, midlong, midwide; shoulders wanting to narrow, oblique; beaks narrow, obtuse, 1 to 1.5 mm. long; awnlets several, 3 to 10 mm. long; kernels red, short, soft to semihard, broadly ovate; germ midsized; crease midwide, shallow to middeep, usually pitted; cheeks rounded; brush small, midlong, sometimes collared.

This is one of the few soft red spring-wheat varieties grown in the United States.

History.—According to S. L. Williams, of the Eugene Mill & Elevator Co., Eugene, Oreg., Huston (C. I. 5208) (reg. 54) was introduced in the vicinity of Eugene in 1876 by a Mr. Belshaw, who obtained a sample of the wheat at the Centennial Exposition, where it was on exhibition as Bulgarian Red Spring. He sowed the few kernels in his garden and in this way obtained sufficient seed to sow 5 acres. His land was low and heavy, however, and the wheat did not prove satisfactory, so he gave the seed to a Mr. Huston living 16 miles west on the hill lands, who grew it with splendid success and the wheat came to be known as Huston.

Distribution.—Estimated area in 1949, 4,687 acres, grown in western Oregon.

Synonyms.—Bulgarian, Early Wonder, Little Red, Ninety-Day.

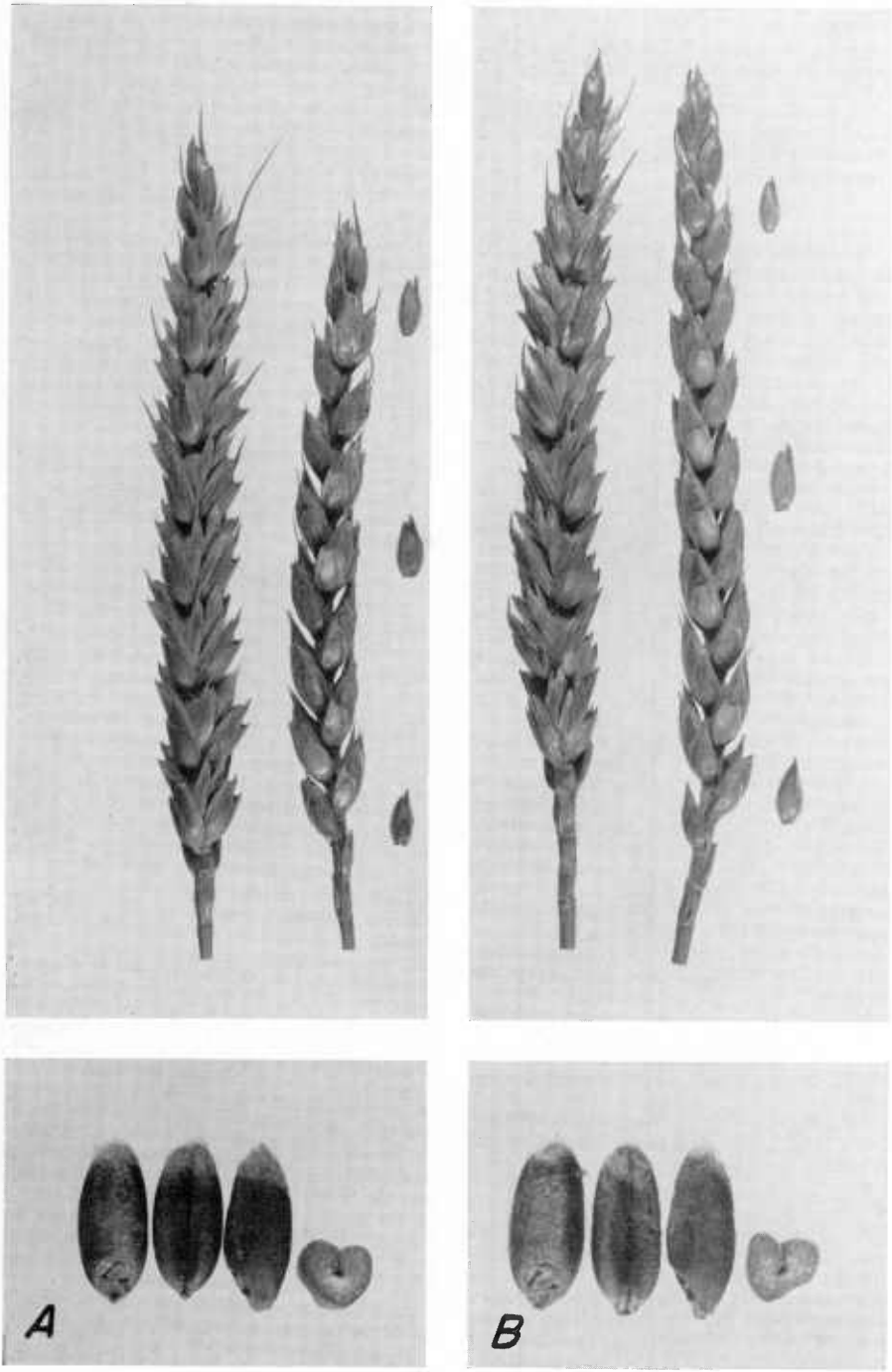

FIGURE 41.—*A*, Newturk and *B*, Ridit wheats: Spikes and glumes, × 1; kernels, × 3.

SEABREEZE

Description.—Plant spring habit, early, midtall; stem purple, midstrong; spike awnleted, oblong to clavate, middense, erect; glumes glabrous, white, midlong, midwide; shoulders narrow, wanting to oblique; beaks midwide, acute, 0.5 mm. long; awnlets several, 5 to 25 mm. long; kernels red, short to midlong, soft, ovate; germ small; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Seabreeze was developed for growing as a feed grain and for grazing in southern Texas. It makes a vigorous leafy growth during the short days of winter and is resistant to many races of stem rust and leaf rust. It has some resistance to loose smut and mildew. It is very early and is not winter-hardy.

History.—Seabreeze (C. I. 12611) was developed at the Texas Agricultural Experiment Station at College Station in cooperation with the Division of Cereal Crops and Diseases from a cross between a selection from Mediterranean-Hope and Gasta made in 1938. Selection 242, later named Seabreeze, was made at College Station in 1941. It was distributed in Texas in the fall of 1945.

Distribution.—Estimated area in 1949, 6,750 acres, grown in southern Texas.

NEWTURK

Description.—Plant winter habit, midseason, midtall; stem white, weak to midstrong; spike awnleted, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to square; beaks wide, acute, 1 mm. long; awnlets few, 3 to 10 mm. long; kernels red, short to midlong, hard, ovate; germ very small; crease narrow to midwide, shallow; cheeks rounded; brush midsized, midlong. (See fig. 41, *A*.)

Newturk is high yielding, more resistant to shattering than Turkey, and equal in quality for breadmaking.

History.—Newturk (C. I. 6935) (reg. 245) was developed in cooperative experiments of the Division of Cereal Crops and Diseases and the Oregon and Montana Agricultural Experiment Stations. It is the result of a cross between Newton (a selection of Alton) and Turkey, made in 1916 at Moro, Oreg. Selections of this cross were sent to the Judith Basin Branch Station, Moccasin, Mont., in 1920. One of these selections (166B–1–6) proved most promising and was named Newturk. Seed of the Newturk variety was distributed for commercial growing in 1926. Its superior characters are good yield and quality and resistance to shattering.

Distribution.—Estimated area in 1949, 82,045 acres, grown in Montana, South Dakota, North Dakota, and Minnesota.

Synonym.—Beardless Turkey.

RIDIT

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform, middense, inclined; glumes glabrous, white, midlong, narrow to midwide; shoulders midwide, oblique to square; beaks midwide, acute, 1 mm. long; awnlets few, 3 to 12 mm. long; kernels red, midlong, hard, elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong. (See fig. 41, *B*.)

It is resistant to many races of bunt and to shattering. Ridit was the first variety bred for resistance to bunt to be distributed for growing in the United States.

History.—Ridit (C. I. 6703) (reg. 248) was developed from a cross between Turkey and Florence made in 1915 at the Washington Agricultural Experiment Station, Pullman. A selection made in 1919 resulted in the Ridit variety. It was distributed for commercial growing in Washington in 1923.

Distribution.—Estimated area in 1949, 75,027 acres, grown in Washington, Idaho, and Montana.

Synonyms.—Selection C, Smutless.

PURKOF

Description.—Plant winter habit, midseason, midtall to tall; stem white, midstrong; spike awnleted, fusiform, middense, nodding; glumes glabrous, white, short, wide; shoulders wide, oblique to square; beaks midwide, obtuse, 1 mm. long; awnlets several, 5 to 25 mm. long; kernels red, short to midlong, hard, ovate to elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 42, *A*.)

Purkof has good winter hardiness, resistance to shattering, and some resistance to leaf rust.

History.—Purkof (C. I. 8381) (reg. 263) was produced from a hybrid between Michigan Amber and Malakof made in 1912 and last selected in 1915 at the Purdue University Agricultural Experiment Station, Lafayette, Ind. It was distributed about 1924.

Distribution.—Estimated area in 1949, 62,835 acres, grown in six States, the largest acreages being in Illinois and Indiana.

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FIGURE 42.—*A*, Purkof and *B*, Chiefkan wheats: Spikes and glumes, × 1; kernels, × 3.

CACHE

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform, lax, erect; glumes glabrous, white, midlong, midwide; shoulders narrow, rounded; beaks midwide, acute, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, midlong, hard, ovate; germ small; crease narrow, shallow; cheeks rounded; brush small, short.

Cache is resistant to many races of bunt and is moderately resistant to dwarf bunt. It has satisfactory milling and breadbaking quality.

History.—Cache (C. I. 11599) was developed at the Utah Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross made in 1927 between Ridit and Utah Kanred. The plant which resulted in Cache was selected in 1931 and was designated as 54a–40 during the testing period (*231*). It was distributed to growers in 1937.

Distribution.—Estimated area in 1949, 154,464 acres on the dwarf-bunt-infested dry lands of Utah, southern Idaho, Montana, and Washington.

CHIEFKAN

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform to oblong, middense to lax, inclined; glumes glabrous, white, usually with black streaks, midlong, midwide; shoulders midwide, oblique to square; beaks wide, obtuse, 0.5 mm. long; awnlets several, 3 to 15 mm. long, partly incurved; kernels red, midlong, hard, ovate to elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong. Kernels of Chiefkan are usually swaybacked, that is, they have a depression on the back midway between the brush and germ. (See fig. 42, *B*.)

Chiefkan is moderately resistant to leaf and stem rust but is very susceptible to loose smut and bunt. It has a high test weight. It differs in breadbaking characteristics from typical hard red winter wheat and is generally disliked by millers in the hard winter-wheat area. Kanhull, a sister selection, differs from Chiefkan in having longer, narrower glumes, taller straw, and longer heads, in being later, and in giving lower yields. The two are difficult to distinguish in the field.

History.—Chiefkan (C. I. 11754) was bred by Earl G. Clark, of Sedgwick, Kans., who also developed Blackhull and Clarkan wheats. It is reported by him to be from a Blackhull × soft wheat hybrid recrossed with Superhard Blackhull (*40*). The first cross was made in 1916. The selection which resulted in Chiefkan was made in 1926 and was first distributed in 1935.

Distribution.—Estimated area in 1949, 425,270 acres (fig. 43).

Synonyms.—Chiefton, Kanhull, Newchief.

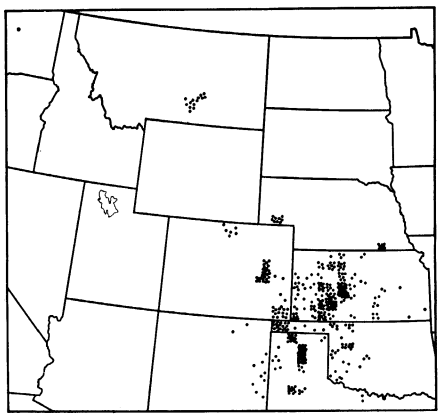


FIGURE 43.—Distribution of Chiefkan wheat in 1949. Estimated area, 425,270 acres.

MICHIKOF

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, oblong, dense, erect to inclined; glumes glabrous, white, short, midwide; shoulders midwide, square to elevated; beaks midwide, acute, 0.5 mm. long; awnlets several, 3 to 12 mm. long; kernels red, short, hard, ovate with truncate tip; germ midsized; crease midwide, middeep; cheeks rounding; brush midsized, midlong.

History.—Michikof (C. I. 6990) (reg. 233) was developed (*227*) at the Purdue University Agricultural Experiment Station, Lafayette, Ind., from a cross made in 1912 between Michigan Amber and Malakof. The final selection was made in 1915, and the variety has been commercially grown since about 1920.

Distribution.—Estimated area in 1949, 580 acres, grown in Illinois.

MOSIDA

Description.—Plant winter habit, midseason, short to midtall; stem white, strong; spike awnleted, oblong, dense, erect, easily shattered; glumes glabrous, white, midlong to long, narrow to midwide; shoulders narrow, oblique to

square; beaks wide, obtuse, 1 mm. long; awnlets several, 5 to 25 mm. long; kernels red, midlong, semihard to hard; germ midsized; crease wide, middeep; cheeks rounded; brush midsized, midlong.

History.—Mosida (C. I. 6688) (reg. 247) was produced from a cross made at the Colorado Agricultural Experiment Station between Fultzo-Mediterranean and Turkey in 1916. The segregating material was taken to the Idaho Agricultural Experiment Station, Moscow, where the selection that is now called Mosida was made in 1918. It was distributed for commercial growing in northern Idaho in 1924. This variety is well adapted to the cutover lands of northern Idaho but is not adapted in areas where shattering is apt to occur.

Distribution.—Estimated area in 1949, 14,335 acres, grown in Idaho, Oregon, Washington, and Montana.

Synonym.—Beardless Turkey.

RED BOBS

Description.—Plant spring habit, early, midtall; stem white, midstrong to strong; spike awnless, fusiform, middense, erect; glumes glabrous, white to yellowish, midlong, midwide; shoulders wide, oblique to square; beaks wide, acute, 0.5 mm. long, sometimes nearly wanting; apical awnlets usually wanting; kernels red, usually short, hard, oval to ovate, with truncate tip; germ midsized; crease midwide to wide, middeep to deep; cheeks angular; brush midsized, short.

This variety has several types of plants. Red Bobs is very susceptible to stem rust.

History.—Red Bobs (C. I. 6255) (reg. 56) was originated from a head selection made in a field of Bobs wheat by Seager Wheeler in 1910 at Maple Grove Farm, Rosthern, Saskatchewan, Canada. It was distributed for the first time in 1918, and its history was recorded the following year by W. N. Burns in the National Alfalfa Journal (*31*). A history of this variety has been recorded by Buller (*28, pp. 259–275*). It is evidently the result of a natural field hybrid between Bobs and a red-kerneled variety. Early Triumph, a selection made from Red Bobs by Seager Wheeler, is very similar to Red Bobs and is here considered a synonym.

Distribution.—Estimated area in 1949, 4,851 acres, grown in Montana. It was also estimated (*186*) grown on 1,480,000 acres in Alberta, Canada.

Synonym.—Early Triumph.

SUPREME

Description.—Supreme differs from Red Bobs in being taller and slightly later, in having lighter green leaves and stems when young, and in being more uniform. (See fig. 44, *A*.)

History.—Supreme (C. I. 8026) (reg. 257) is a selection from Red Bobs made by Seager Wheeler at Rosthern, Saskatchewan, Canada. The variety has been grown commercially in Canada since 1922 and in Montana since 1924, seed having been obtained by the Montana Agricultural Experiment Station, Bozeman, in March 1922. It outyields Marquis in Montana, is 4 to 7 days earlier, and has stronger stems.

Distribution.—Estimated area in 1949, 74,386 acres, grown in Montana, North Dakota, South Dakota, Wyoming, Minnesota, and New Mexico.

REDMAN

Description.—Plant spring habit, early, short to midtall; stem white, strong; spike awnleted, fusiform, lax to middense, erect; glumes glabrous, white, midlong to long, midwide, shoulders narrow to midwide, oblique to rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, short, hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 44, *B*.)

Redman is slightly earlier than Thatcher, is resistant to stem rust (except race 15B) and to bunt, and to some races of leaf rust and loose smut. It is equal to Thatcher in milling and breadbaking quality.

History.—Redman (C. I. 12638) was developed at the Dominion Laboratory of Cereal Breeding at Winnipeg, Manitoba, Canada, from a cross between Regent and Canus made in 1934 (*150*). The original distribution was designated as R. L. 1834.1 (C. I. 12496) and was distributed in 1945. A selection from this strain was designated as R. L. 1834.7 (C. I. 12638) and increased for distribution in 1947.

Distribution.—Estimated area in 1949, 136,057 acres, grown in Minnesota, North Dakota, South Dakota, Montana, and Wisconsin. Redman was also estimated grown on 643,200 acres in Manitoba and Saskatchewan, Canada, in 1949 (*186*).

GARNET

Description.—Plant spring habit, early, short to midtall; stem white, slender, weak to midstrong; spike awnleted, fusiform, middense to lax, inclined, easily shattered; glumes glabrous, white, long, narrow; shoulders wanting to rounded;

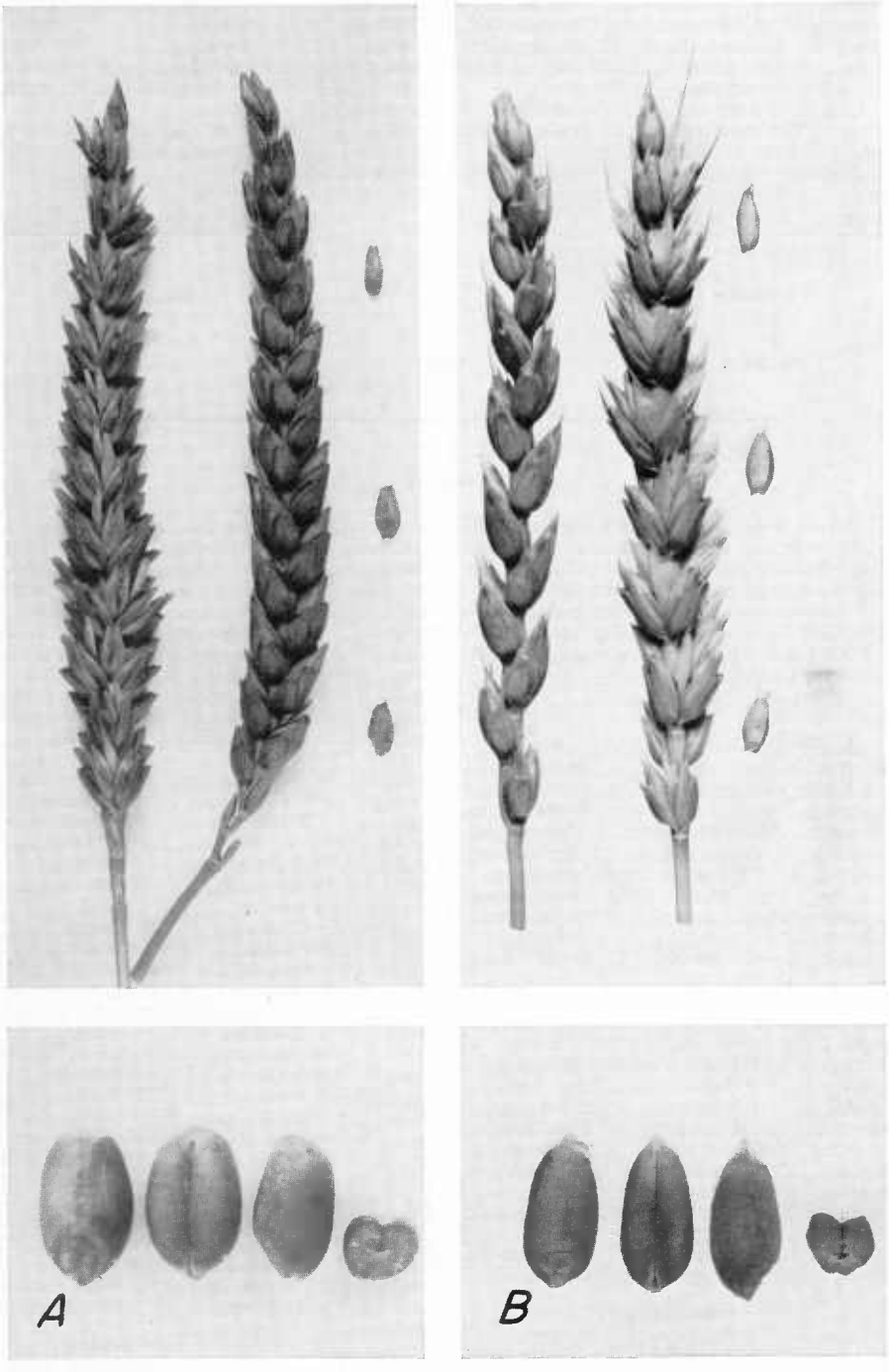


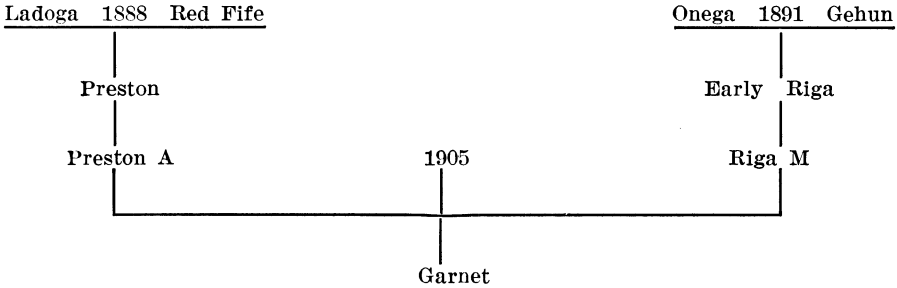
FIGURE 44.—*A*, Supreme and *B*, Redman wheats: Spikes and glumes, × 1; kernels, × 3.

beaks narrow, acute, 1 mm. long; awnlets several, 3 to 15 mm. long; kernels red, short to midlong, hard, elliptical; germ large; crease narrow, midwide; cheeks rounded; brush small, midlong.

Garnet is very early and is resistant to bunt. The quality of the grain is not equal to that of Marquis.

History.—Garnet (C. I. 8181) (reg. 260) was originated from a cross made at Central Experimental Farm, Ottawa, Canada, in 1905, by C. E. Saunders, and was distributed for commercial production in the Prairie Provinces of Canada in the spring of 1926.

The parentage of Garnet has been recorded by Newman and Whiteside (*151*) as follows:



Garnet was first grown at experiment stations in the United States in 1925 and was first introduced from Canada by commercial growers in about 1928.

Distribution.—It was not reported in the United States in 1949, but an estimated (*186*) 640,900 acres were grown in Alberta, Canada.

COMET

Description.—Plant spring habit, early, short to midtall; stem white, strong; spike awnleted, oblong, middense, erect; glumes glabrous, white, midlong, midwide to wide; shoulders wide, rounded to square; beaks wide, acute, 0.5 mm. long; awnlets several, 3 to 25 mm. long; kernels red, midlong, hard, ovate; germ large; crease middeep; cheeks angular; brush midsized, midlong.

History.—Comet (C. I. 11465) (reg. 315) was developed in cooperative experiments of the Division of Cereal Crops and Diseases and the Montana Agricultural Experiment Station from a cross of Marquis and Hard Federation made in 1921. It has been extensively used in breeding, but it has not been distributed for commercial growing in Montana or in other States of the hard spring wheat region. Comet was tested in the western regional nursery for a number of years and was distributed for growing in central Oregon in 1940.

Distribution.—Estimated acreage in 1949, 1,000 acres, grown in Oregon.

THATCHER

Description.—Plant spring habit, early to midseason, short to midtall; stem white, strong; spike awnleted, oblong to fusiform, middense, erect; glumes glabrous, white (with coffee-colored stains), short to midlong, midwide; shoulders midwide, rounded to square to elevated; beaks narrow, obtuse to acute, 0.5 to 1 mm. long; awnlets many, 5 to 20 mm. long, incurved; kernels light red, short, hard, ovate; germ midsized; crease midwide, middeep; cheeks angular; brush midsized to large, midlong. (See fig. 45, *A*.)

Thatcher is resistant to stem rust (except race 15B) but is susceptible to leaf rust. It has a short stiff straw and is resistant to lodging and shattering. It has strong gluten and is very satisfactory for breadmaking. Its test weight is relatively low.

History.—Thatcher (C. I. 10003) (reg. 277) was developed in cooperative experiments of the Minnesota Agricultural Experiment Station and the Division of Cereal Crops and Diseases. It is the result of a so-called double cross; i. e., from a cross between a selection of Marquis × Iumillo and a selection of Marquis × Kanred made in 1921 at University Farm, St. Paul, Minn. The plant selection, which resulted in Thatcher, was made in 1925 and was first grown in field plots in 1929 (*95*). It was distributed for commercial growing in 1934.

Thatcher proved to be very resistant to stem rust in the severe epidemics of 1935 and 1937, and its acreage increased very rapidly both in the United States and in Canada, where it was officially approved for distribution in 1937.

Distribution.—Estimated area in the United States in 1949, 3,370,823 acres

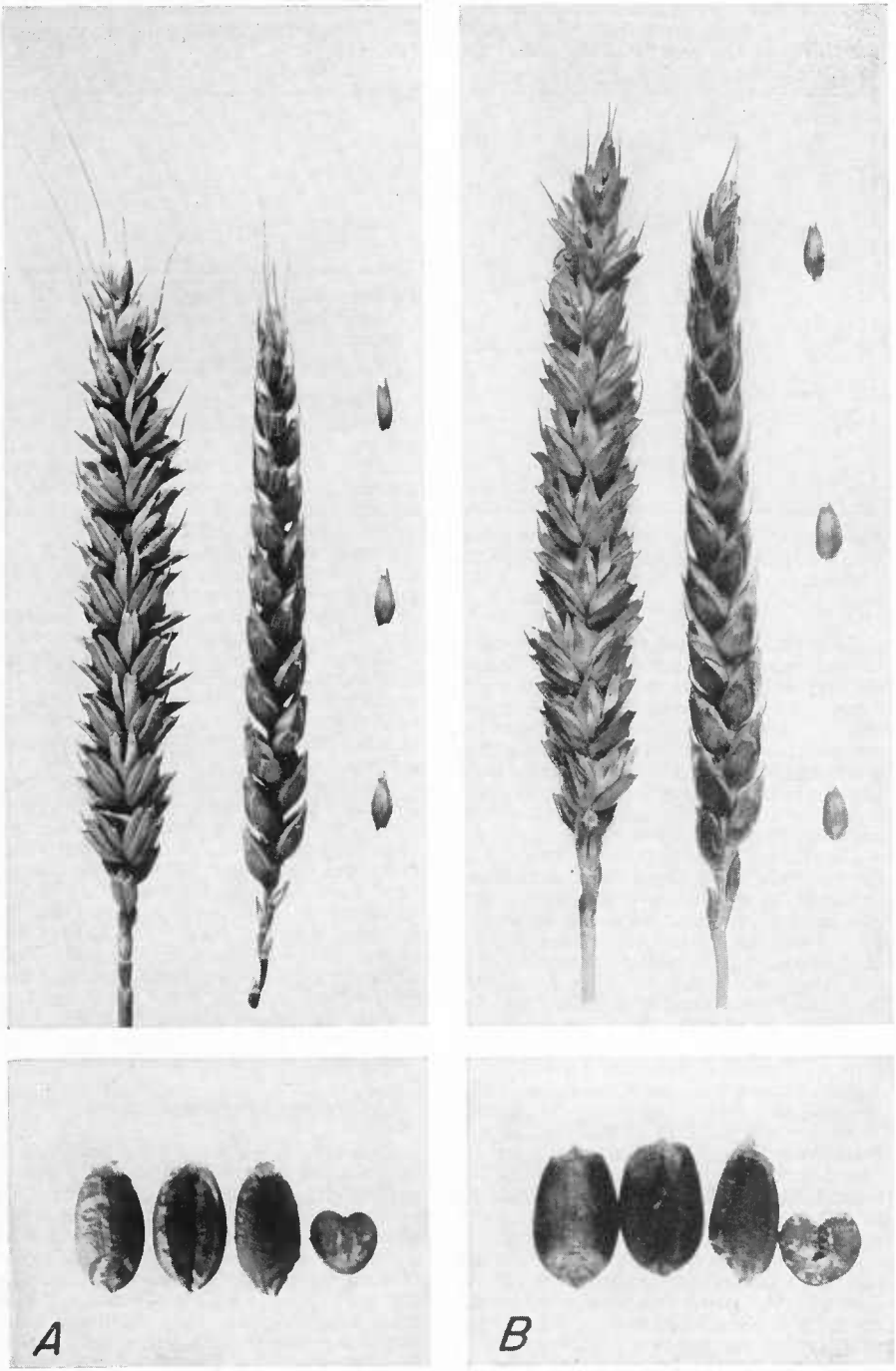


FIGURE 45.—*A*, Thatcher and *B*, Marquis wheats: Spikes and glumes, × 1; kernels, × 3.

(fig. 46). It was estimated that 15,336,900 acres were grown in the Prairie Provinces of Canada in 1949 (*186*).

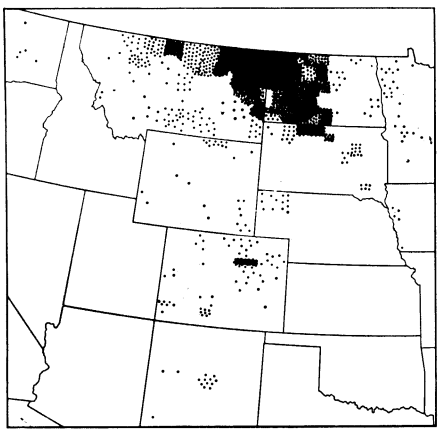


FIGURE 46.—Distribution of Thatcher wheat in 1949. Estimated area, 3,370,823 acres.

NEWTHATCH

Description.—Plant spring habit, early to midseason, midtall; stem white, strong; spike awnleted, fusiform, middense, erect; glumes glabrous, white, short, midwide; shoulders midwide, rounded; beaks narrow, acute, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, short, hard, ovate; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong.

Newthatch is resistant to stem rust (except race 15B), loose smut, and bunt, but it is susceptible to some races of leaf rust and to fusarial head blight (scab). It is resistant to lodging and has good milling and breadmaking properties.

History.—Newthatch (C. I. 12318) (reg. 335) was developed in cooperative experiments of the Minnesota Agricultural Experiment Station and the Division of Cereal Crops and Diseases. It was produced by backcrossing in which the initial cross between Hope and Thatcher was made in 1930. The F_1 was backcrossed to Thatcher in the greenhouse during the winter of 1930–31. The second backcross was made to Thatcher in the summer of 1931. Seven strains selected in the F_5 generation from the second backcross were found to be similar and were bulked to produce the variety Newthatch. All seven strains were derived from a single F_2 plant. They were first grown in rod-row trials in 1939. Newthatch was released to growers in 1944 (*11*).

Distribution.—Estimated area in 1949, 282,076 acres, grown in four States (fig. 47).

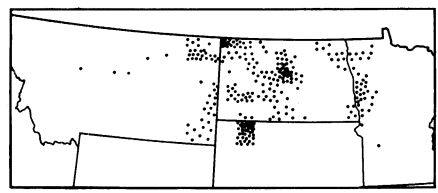


FIGURE 47.—Distribution of Newthatch wheat in 1949. Estimated area, 282,076 acres.

MARQUILLO

Description.—Plant spring habit, early to midseason, short to midtall; stem white, midstrong to strong; spike awnleted, fusiform, middense, erect; glumes glabrous, white, sometimes showing streaks of brown or black, midlong, midwide; shoulders midwide, rounded to elevated; beaks wide, acute, 1 to 1.5 mm. long; awnlets many, 5 to 20 mm. long; kernels red, midlong to long, hard, ovate; germ large; crease middeep; cheeks angular; brush midlarge, midlong, collared.

Marquillo is resistant to stem rust and moderately resistant to hessian fly. The grain produces a yellowish flour and in that respect is undesirable. The variety, as shown by Powers (*164*), is not entirely stable.

History.—Marquillo (C. I. 6887) (reg. 237) was produced in cooperative experiments between the Minnesota Agricultural Experiment Station and the Division of Cereal Crops and Diseases, at University Farm, St. Paul, Minn. It is the result of a cross between Marquis and Iumillo durum made in 1914. The selection II–15–44, later named Marquillo, was made in 1918 and was first distributed in 1928.

Distribution.—Estimated area in 1949, 1,053 acres, grown in Minnesota.

Synonym.—Minnesota No. 2202.

CARLEEDS (NORDHOUGEN)

Description.—Plant spring habit, early to midseason, midtall to tall; leaves pubescent; stem white, midstrong; spike awnleted, fusiform, middense, erect, easily shattered; glumes glabrous, yellowish white, midlong, wide; shoulders wide, oblique to square; beaks wide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, midlong, hard, elliptical; germ midsized; crease wide, middeep; cheeks angular; brush large, midlong.

Carleeds is resistant to stem rust but susceptible to leaf rust. Its test weight is somewhat low. The kernels appear to be somewhat softer than those of the leading varieties of hard red spring wheat, and, in commercial tests, the gluten characteristics are said to be different from those of the better varieties.

History.—The origin of Carleeds (C. I. 11801) is uncertain. It was developed by Carl Nordhougen, of Leeds, N. Dak., and distributed in 1936. Mr. Nordhougen states that he is not certain regarding the exact parentage, as he did not make a record of his crosses, but thinks it may be the result of crossing two selections from a Hope × Marquis hybrid and in turn crossing a selection from this double cross with Florence. The variety appears to have the resistance of Hope to stem rust.

Distribution.—Estimated area in 1949, 8,004 acres, grown in North Dakota and Minnesota.

Synonym.—Nordhougen.

MARQUIS

Description.—Plant spring habit, midseason, midtall; stem white, midstrong; spike awnleted, fusiform, dense, erect to inclined; glumes glabrous, white to yellowish, short, wide; shoulders midwide to wide, usually square; beaks wide, acute, 0.5 mm. long; awnlets few, 3 to 10 mm. long; kernels red, short, hard, ovate, with truncate tip; germ midsized; crease wide, deep; cheeks angular; brush midsized, midlong. (See fig. 45, *B*.)

History.—Marquis (C. I. 3641) (reg. 57) is of hybrid origin, having been originated by the cerealists of the Dominion Department of Agriculture at the Central Experimental Farm, Ottawa, Canada. The crossing that resulted in Marquis was done under the direction of William Saunders, but the credit is due C. E. Saunders for selecting, naming, testing, and distributing the variety. He has given an account of its origin in the following words (*176, pp. 118–120*):

> All the details in regard to the origin of Marquis are not available, but it is one of the descendants of a cross between an early-ripening Indian wheat, Hard Red Calcutta (as female) and Red Fife (as male). The cross * * * was made by Dr. A. P. Saunders, probably at the Experimental Farm at Agassiz, in the year 1892. The crossbred seeds, or their progeny, were transferred to Ottawa, and [when the] writer of this report was appointed in 1903 to take charge of the work of cereal breeding, he made a series of selections from the progeny of all the crossbred wheats which had been produced at Ottawa up to that time. Some of these had been named and others were under numbers. Though they had all been subjected to a certain amount of selection, each of them consisted of a mixture of related types. In some cases all the types present were similar. In other instances striking differences were observed. The grain which had descended from the cross referred to above was found by careful study of individual plants (especially by applying the chewing test to ascertain the gluten strength and probable breadmaking value) to be a mixture of similar-looking varieties which differed radically in regard to gluten quality. One of the varieties isolated from this mixture was subsequently named Marquis. Its high breadmaking strength and color of flour were demonstrated in the tests made at Ottawa in the early months of 1907, and all the surplus seed was at once sent to the Indian Head Experimental Farm for propagation.
>
> It will be clearly seen from the above account that the question "When was Marquis wheat originated?" can never be answered. It came into existence probably at Ottawa between the years 1895 and 1902. It remained, however, mixed with other related sorts until discovered by the writer in 1903. It was first grown in a pure state in 1904, when a few seeds were sown in a sheltered garden on the Central Experimental Farm. Even then, however, its fine qualities were only partly known, and it was not until the cerealist's baking tests of 1907 were completed that he decided to send out this wheat for trial in Saskatchewan. Its success in the prairie country was phenomenal.

Marquis wheat was first sent to the Prairie Provinces of Canada in 1907, where it was thoroughly tested at experiment stations. At Indian Head and Rosthern, Saskatchewan, and at Brandon, Manitoba, it very significantly outyielded all other varieties. By 1911 the variety had become commercially established in Canada.

Attention was first attracted to Marquis wheat in the United States through its having won premiums at several expositions. Seed was introduced by the United States Department of Agriculture in 1912 and 1913, and the variety was thoroughly tested at numerous experiment stations in the spring-wheat sections. These and other experiments, reported

by Ball and Clark (*15*, *16*), proved the variety to be widely adapted. In the meantime, in consequence of much publicity, a strong demand for seed arose. A considerable quantity was brought into the country for sowing in 1913. Much larger quantities were imported in 1914. The importations of these 2 years, with the seed homegrown in 1913, were sufficient to sow about half a million acres in 1914. Most of the imported seed was sold in Minnesota, North Dakota, and Montana. Smaller quantities were sold in other spring-wheat States. In this way the Marquis variety became widely distributed in a very short time. In 1919, only 7 years after its introduction, it made up at least 60 percent, or nearly 12,000,000 acres, of the total spring-wheat acreage of the United States. For more than 15 years it was the most widely grown spring wheat. Following the severe rust epidemic of 1935, much of the acreage of Marquis was replaced by Thatcher.

Distribution.—Estimated area in 1949, 882,382 acres (fig. 48). Marquis was also grown, it was estimated (*186*), on 1,292,600 acres in the Prairie Provinces of Canada in 1949.

RESCUE

Description.—Plant spring habit, midseason to late, tall; stem white, weak, solid; spike awnleted, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 3 to 8 mm. long; kernels red, short, hard, ovate; germ small; crease narrow, shallow; cheeks rounded; brush small, short. (See fig. 49, *A*.)

Rescue has solid stems and is resistant to the western wheat stem sawfly. It is somewhat resistant to stem rust but is susceptible to leaf rust and bunt. It has a low protein content and water absorption and is not considered equal to Thatcher in breadbaking quality, although the loaf volume is good.

History.—Rescue (C. I. 12435) was developed at the Dominion Experiment Station at Swift Current, Saskatchewan, Canada, from a cross between Apex and S–615 made at Ottawa in 1938. It was selected for resistance to wheat stem sawfly and has solid stems like the S–615 parent, which was introduced from New Zealand. It was designated as Swift

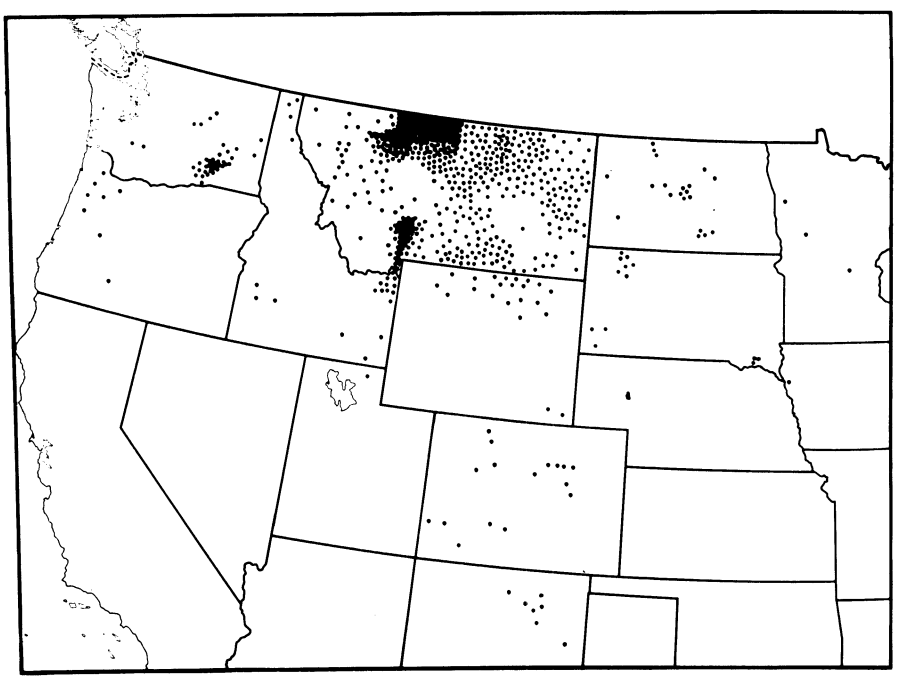


FIGURE 48.—Distribution of Marquis wheat in 1949. Estimated area, 882,382 acres.

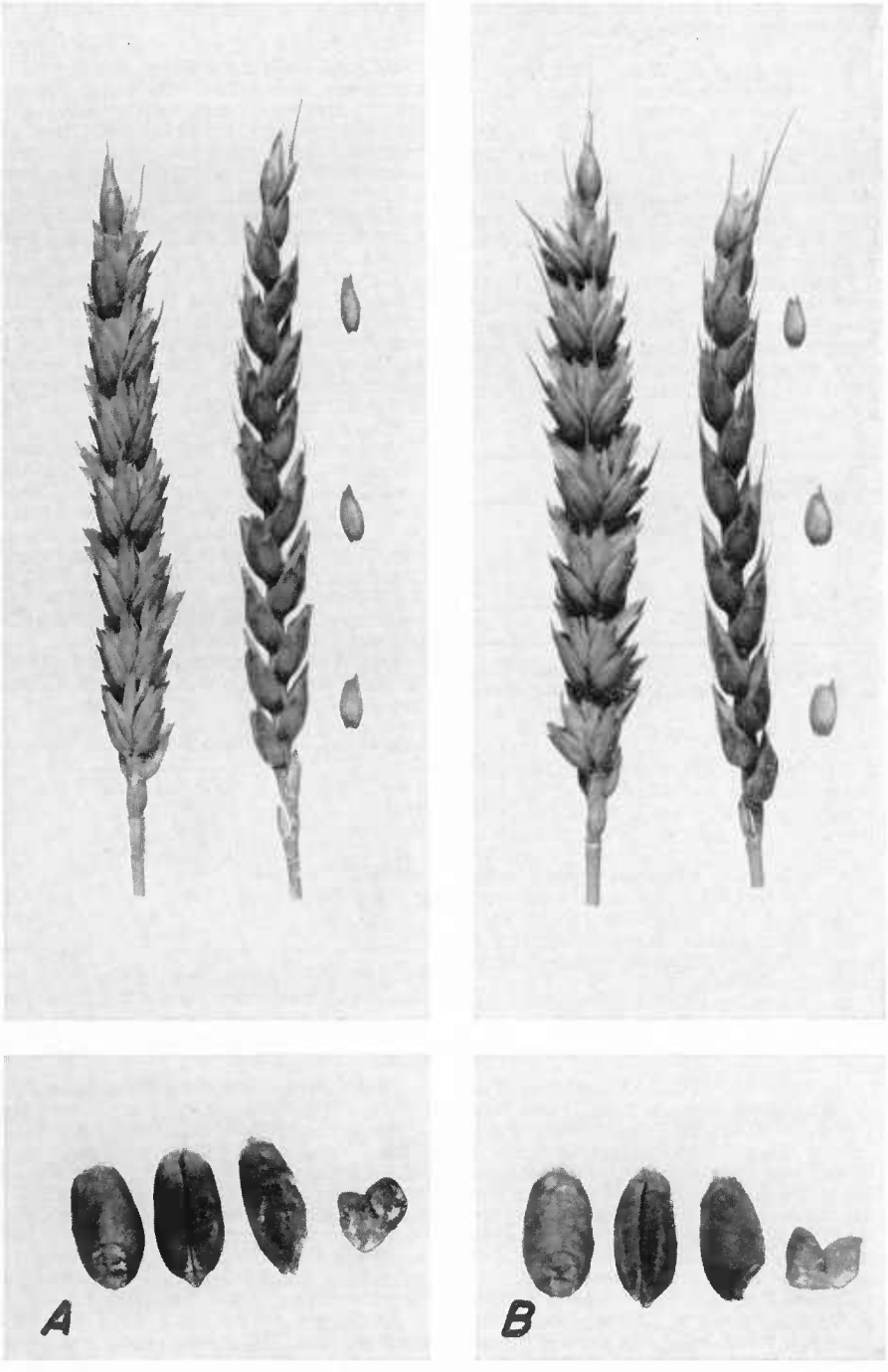


FIGURE 49.—*A*, Rescue and *B*, Cadet wheats: Spikes and glumes, × 1; kernels, × 3.

Current No. 4188 (*150*). Two bushels of seed were furnished to the Montana station in the fall of 1944. One bushel was fall-planted at Mesa, Ariz., and 35 bushels were returned to Montana in time to plant in the spring of 1945. This summer crop produced 900 bushels. In the fall of 1945 the Montana Seed Growers contracted for the fall seeding of 100 acres at Yuma, Ariz. As a result of growing two crops in each of 2 years, 60,000 bushels were available for seeding in Montana in 1947.

Distribution.—Rescue is grown in the sawfly-infested areas of Saskatchewan, Canada, and of Montana and northwestern North Dakota. 1,730,000 acres were grown in Saskatchewan in 1949 (*186*), and 916,147 acres in the United States (fig. 50).

FIGURE 50.—Distribution of Rescue wheat in 1949. Estimated area, 916,147 acres.

APEX

Description.—Plant spring habit, midseason, short to midtall; stem white, midstrong; spike awnleted, fusiform, middense, erect; glumes glabrous, white, short to midlong, midwide; shoulders wide, oblique to rounded; beaks wide, obtuse, 0.5 to 1 mm. long; awnlets several, 5 to 15 mm. long; kernels red, short, hard, ovate; germ midsized; crease narrow to midwide, middeep; cheeks rounded; brush midsized, midlong.

Apex is resistant to stem rust (except race 15B) and loose smut and to some races of bunt. Its breadmaking quality is satisfactory.

History.—Apex (C. I. 11636) (reg. 320) was developed from a cross between an F_1 plant of H–44 × [Marquis-Iumillo × Kanred-Marquis] and Marquis made in 1927 at the University of Saskatchewan, Saskatoon, Saskatchewan, Canada. Marquis thus entered the parentage four times. Apex was released for commercial growing in 1937 when about 1,500 acres were grown in Saskatchewan (*150*).

Distribution.—Estimated area in 1949, 7,220 acres, grown in Montana and North Dakota. Apex was also grown, it was estimated (*186*), on 239,300 acres in Saskatchewan, Canada, in 1949.

CADET

Description.—Plant spring habit, midseason, midtall; stem white, strong; spike awnleted, oblong to fusiform, middense, erect; glumes glabrous, white, short, midwide; shoulders midwide, oblique to rounded; beaks midwide, acute, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, short, hard, ovate; germ midsized; crease wide, deep; cheeks angular; brush midsized, midlong. (See fig. 49, *B*.)

Cadet is resistant to stem rust (except race 15B) and to some races of leaf rust, loose smut, and mildew. It has good straw and does not shatter easily. It is about 3 days later than Thatcher and grows taller. It has excellent milling and breadbaking properties.

History.—Cadet (C. I. 12053) (reg. 343) was developed from a cross between Merit and Thatcher made in 1936 in the greenhouse of the Division of Cereal Crops and Diseases at Washington, D. C. It was selected for several generations at experiment stations in North Dakota and Montana. An F_6 selection, 1290A–1–76–7–3–1, N. No. 1597, after thorough testing, was named "Cadet" and distributed in 1946 in North Dakota.

Distribution.—Estimated area in 1949, 626,282 acres, grown in four States (fig. 51).

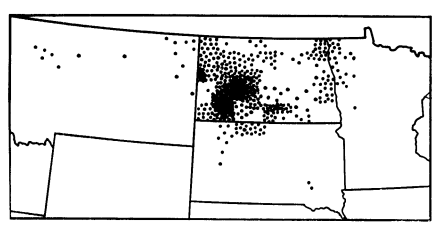


FIGURE 51.—Distribution of Cadet wheat in 1949. Estimated area, 626,282 acres.

RUSHMORE

Description.—Plant spring habit, early, short to midtall; stem purple, strong; spike awnleted, fusiform, middense, erect; glumes glabrous, white, midlong, midwide to wide; shoulders midwide, rounded to square; beaks midwide, acute, 0.5 mm. long; awnlets several, 3 to 10 mm. long; kernels red, short to midlong, hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 52, *A*.)

Rushmore is resistant to stem rust (except race 15B), loose smut, bunt, and to some races of leaf rust. It is early, has stiff straw, and has yielded well in

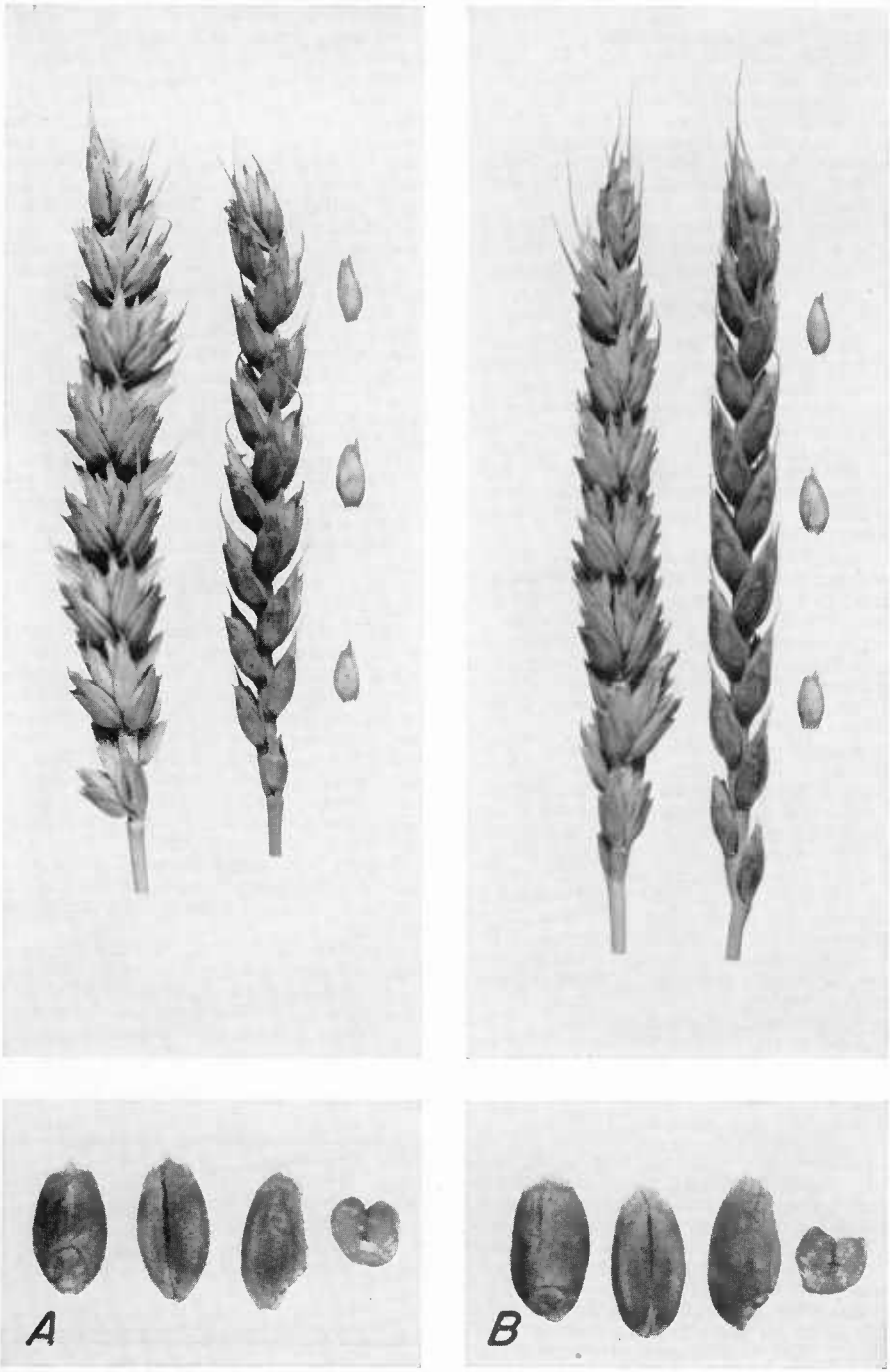


FIGURE 52.—*A*, Rushmore and *B*, Regent wheats: Spikes and glumes, ×1; kernels, ×3.

South Dakota. It has good milling and breadbaking characteristics.

History.—Rushmore (C. I. 12273) (South Dakota 2280) was selected from a cross between Rival and Thatcher, made at Brookings, S. Dak., in 1937 (*88*). It was entered in the uniform hard red spring-wheat nursery in 1942. About 4,800 bushels were distributed in South Dakota in 1949.

Distribution.—Estimated area in 1949, 16,031 acres, grown in South Dakota, North Dakota, Montana, and Minnesota.

SAUNDERS

Description.—Plant spring habit, early, short; stem purple, strong; spike awnleted, fusiform, middense, erect; glumes glabrous, white, midlong, midwide; shoulders midwide, rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, short, hard, ovate; germ midsized; crease narrow, shallow; cheeks rounded; brush midsized, midlong.

Saunders is resistant to stem rust (except race 15B) and loose smut and moderately resistant to bunt, root rot, and black chaff. It is susceptible to some races of leaf rust. Saunders has satisfactory milling and breadmaking quality. The kernels closely resemble those of Marquis. It matures 2 to 3 days earlier than Thatcher.

History.—Saunders (C. I. 12567) (C. A. N. 3516) (reg. 344) was developed from a cross between Brandon selection C–26–44.7 from Hope × Reward and Thatcher made at Central Experimental Farm, Ottawa, Ontario, Canada, in 1938. It was designated as CT 406 (*81*). It was licensed in 1947 and released for commercial production in 1948. Saunders was bred to replace Garnet and Red Bobs in northern Alberta and northwestern Saskatchewan and is recommended in that region.

Distribution.—Saunders was not reported in the United States in 1949 but was grown on an estimated 1,265,000 acres in Alberta, Canada (*186*).

RENOWN

Description.—Plant spring habit, early to midseason, short to midtall; leaves pubescent; stem purple, midstrong; spike awnleted, fusiform, middense, erect; glumes (glaucous and light green before maturity) glabrous, white, midlong, midwide; shoulders midwide to wide, rounded; beaks wide, acute, 0.5 mm. long; awnlets few, 2 to 10 mm. long; kernels dark red, short, hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Renown is resistant to stem rust (except race 15B), bunt, and powdery mildew and is moderately resistant to leaf rust. It has satisfactory breadmaking quality.

History.—Renown (C. I. 11709) (reg. 325) was produced at the Dominion Rust Research Laboratory, Winnipeg, Manitoba, from a cross between H–44–24 (a sister selection of Hope) and Reward made in 1926 (*150*). The selection (Rust Laboratory No. 716A), which was later named Renown, was made in 1927. About 6,000 acres were grown in Canada in 1937. The seed released in 1937 was of slightly inferior grain quality and higher in carotenoid content than most hard red spring-wheat varieties, but a reselection (Rust Laboratory 716–6) (C. I. 11947) made in 1932 was found in experimental tests to be more satisfactory and was released in 1939.

Distribution.—Estimated area in 1949, 20,376 acres, grown in Minnesota, North Dakota, and Montana. It was also estimated (*186*) that Renown was grown on 155,500 acres in Manitoba, Canada, in 1949.

REGENT

Description.—Plant spring habit, early to midseason, short to midtall; stem purple, midstrong; spike awnleted, oblong, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders narrow, wanting to oblique; beaks narrow, acute, 0.5 mm. long; awnlets few, 2 to 10 mm. long; kernels dark red, midlong, hard, ovate; germ small; crease wide, deep; cheeks angular; brush midsized, midlong. (See fig. 52, *B*.)

Regent is resistant to stem rust (except race 15B) and bunt and to some races of leaf rust. It is of high quality for breadmaking.

History.—Regent (C. I. 11869) (reg. 327) was developed from a cross between H–44 and Reward made in 1926 at the Dominion Rust Research Laboratory at Winnipeg, Manitoba. Selection R. L. 975.1, which resulted in Regent, was made in 1932 (*150*). It was first released in 1939, when about 11,000 bushels were

FIGURE 53.—Distribution of Regent wheat in 1949. Estimated area, 441,392 acres.

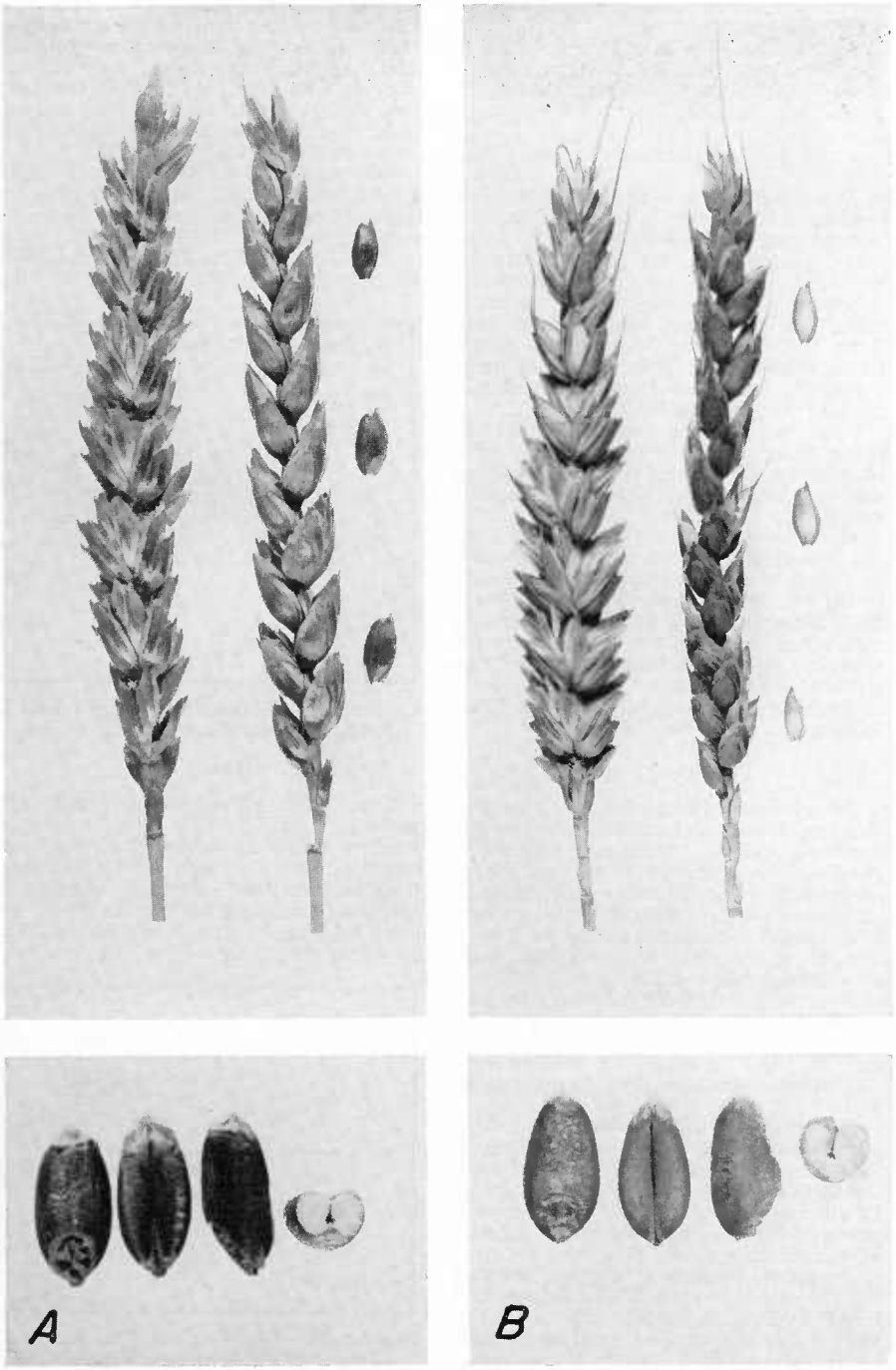


FIGURE 54.—*A*, Rex and *B*, Cornell 595 wheats: Spikes and glumes, × 1; kernels, × 3.

distributed in Manitoba and eastern Saskatchewan.

Distribution.—Estimated area in 1949, 441,392 acres (fig. 53). An estimated (*186*) 984,000 acres were grown in Manitoba, Canada.

KITCHENER

Description.—Plant spring habit, midseason, midtall to tall; stem purple, strong; spike awnleted, oblong to subclavate, middense, erect; glumes glabrous, yellowish white, short, wide; shoulders midwide, oblique to square; beaks midwide, acute, 0.5 mm. long; awnlets few, 3 to 10 mm. long; kernels red, short, hard, ovate, with truncate tips; germ midsized; crease wide, middeep; cheeks angular; brush midsized, midlong.

Kitchener differs from Marquis in being taller and later and in having a broader spike, purple straw, and a slightly longer and more rectangular kernel.

History.—Kitchener (C. I. 4800) (reg. 66) was originated from a head selected in a field of Marquis by Seager Wheeler in 1911 at Maple Grove Farm, Rosthern, Saskatchewan, Canada. It was increased and tested for yield by Mr. Wheeler for a period of 4 or 5 years and then distributed (*226, pp. 8–9*).

Distribution.—Estimated area in 1949, 1,078 acres, grown in Colorado.

REX

Description.—Plant winter habit, early, short to midtall; stem white, strong; spike awnless, oblong, middense, inclined; glumes glabrous, brown, short to midlong, midwide to wide; shoulders wide, rounded to square; beaks wide, obtuse, 1 mm. long; awnlets usually wanting or 1 to 3 mm. long; kernels yellowish white, short to midlong, soft, oval; germ midsized; crease wide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 54, *A*.)

Rex is resistant to some races of bunt and is very resistant to lodging and shattering. Grain of Rex is difficult to mill.

History.—Rex (C. I. 10065) (reg. 276) was developed at the Sherman Branch Experiment Station, Moro, and the Pendleton Branch Experiment Station, Pendleton, Oreg., in cooperative experiments of the Oregon Agricultural Experiment Station and the Division of Cereal Crops and Diseases. It was selected from a cross between White Odessa and Hard Federation which was made in 1921. The plant selection that resulted in Rex was made in 1926. It was found to carry the factors from White Odessa for resistance to some races of bunt. It was released for commercial growing in 1933. Because of its resistance to lodging, shattering, and some races of bunt and its combination of early maturity and winter hardiness, all of which result in good yields, Rex has been extensively grown in the Pacific Northwest.

Rex was found not to be pure for plant height, and a strain (Rex M1) pure for the shorter and earlier type was increased and distributed in the fall of 1938.

Distribution.—Estimated area in 1949, 427,413 acres (fig. 55).

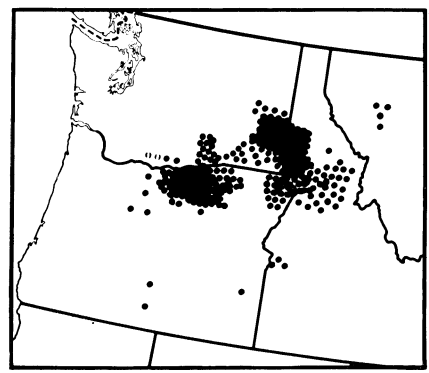


FIGURE 55.—Distribution of Rex wheat in 1949. Estimated area, 427,413 acres.

CORNELL 595

Description.—Plant winter habit, midseason, midtall; stem mostly purple, strong; spike awnleted, fusiform, lax, erect; glumes glabrous, brown, midlong, midwide; shoulders narrow, wanting to rounded; beaks narrow to midwide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels white, midlong,

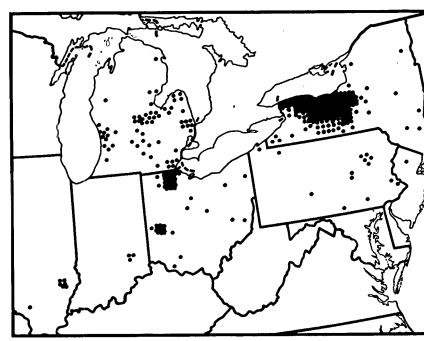


FIGURE 56.—Distribution of Cornell 595 wheat in 1949. Estimated area, 335,894 acres.

soft, ovate; germ midsized; crease midwide, deep; cheeks angular; brush midsized, midlong. (See fig. 54, *B.*)

Cornell 595 has a very stiff straw and is resistant to mosaic and to some races of loose smut and mildew. It is also resistant to *Septoria tritici* and has good soft-white-wheat quality.

History.—Cornell 595 (C. I. 12372) was developed at the Cornell University Agricultural Experiment Station, Ithaca, N. Y., in investigations cooperative with the Division of Cereal Crops and Diseases from crossing an F_1 between Honor and Forward with Nured, then backcrossing this F_1 to Honor. The best of many selections was distributed in 1942 as Cornell 595 (*137*).

Distribution.—Estimated area in 1949, 335,894 acres (fig. 56).

GENESEE

Description.—Plant winter habit, midseason, midtall; stem white, strong; spike awnleted, oblong, middense, erect; glumes glabrous, brown, short, midwide; shoulders midwide, square; beaks midwide, obtuse, 0.6 mm. long; awnlets 1 to 3 mm. long; kernels white, short to midlong, soft, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Genesee has a stiff straw, is resistant to some races of loose smut, and has good soft-white-wheat quality.

History.—Genesee (C. I. 12653) was developed in cooperative investigations at the Cornell University Agricultural Experiment Station, Ithaca, N. Y., from the cross (Honor-Forward × Honor) × Yorkwin. During the testing period it was designated as Cornell 828a1–2–3. It was distributed in the fall of 1951 (*114*).

DAWSON

Description.—Plant winter habit, midseason, midtall; stem white, strong; spike awnleted, linear-oblong, middense, inclined; glumes glabrous, light brown, midlong, wide; shoulders wide, oblique to square; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 3 to 20 mm. long; kernels white, short to midlong, soft, ovate to oval; germ midsized to large; crease midwide to wide, middeep; cheeks usually angular; brush midsized, midlong.

Dawson differs from Goldcoin chiefly in having white straw, an oblong spike, and no collar around the brush. This variety is very resistant to the hessian fly found in California.

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History.—Dawson (C. I. 3342) (reg. 69) was originated in 1881 by Robert Dawson, of Paris, Ontario, Canada (*189, p. 8*). It was selected (*232, p. 11*) from "a field of Seneca or Clawson in which he found one plant quite distinct and much superior to the rest of the crop. Mr. Dawson sowed the grain from this plant and has continued to grow this wheat since that time."

Distribution.—Estimated area in 1949, 58,390 acres, grown in Michigan, Ohio, New York, Illinois, Indiana, Pennsylvania, and Wisconsin.

Synonyms.—American Banner, Dawson Golden Chaff, Golden Bronze, Golden Chaff.

GOLDCOIN (FORTYFOLD)

Description.—Plant winter habit, midseason, short to midtall; stem purple, strong; spike awnleted, clavate, middense, erect to inclined, easily shattered; glumes glabrous, brown, long, midwide; shoulders midwide, oblique to square; beaks wide, obtuse, 1 mm. long; awnlets several, 5 to 15 mm. long; kernels white, short to midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks usually rounded; brush small, midlong, collared.

The distinctive characters of Goldcoin wheat are the purple straw, clavate spike, and collared brush. (See fig. 57, *A.*)

History.—Goldcoin (C. I. 4156) (reg. 74) is probably a descendant from the Redchaff or Redchaff Bald wheat mentioned in early agricultural literature as being grown in the Genesee Valley of New York, as early as 1798. The following history of Redchaff was recorded by Allen (*8, p. 153*) in 1885:

> *The old Genesee Red-chaff* is a bald, white wheat, first cultivated in the same region in 1798, and for a long time it was the decided favorite. Since 1820, however, it has been very subject to rust and blast, but when circumstances are favorable it is still found to be highly productive. Its transfer to other localities may therefore be attended with great success.

For a more complete history, especially of the synonyms of Goldcoin, see Technical Bulletin 459 (*43*).

Distribution.—Estimated area in 1949, 359,678 acres, grown in six States (fig. 58). The acreage has decreased greatly in recent years.

Synonyms.—Fortyfold, Junior No. 6, Klondike, White Clawson.

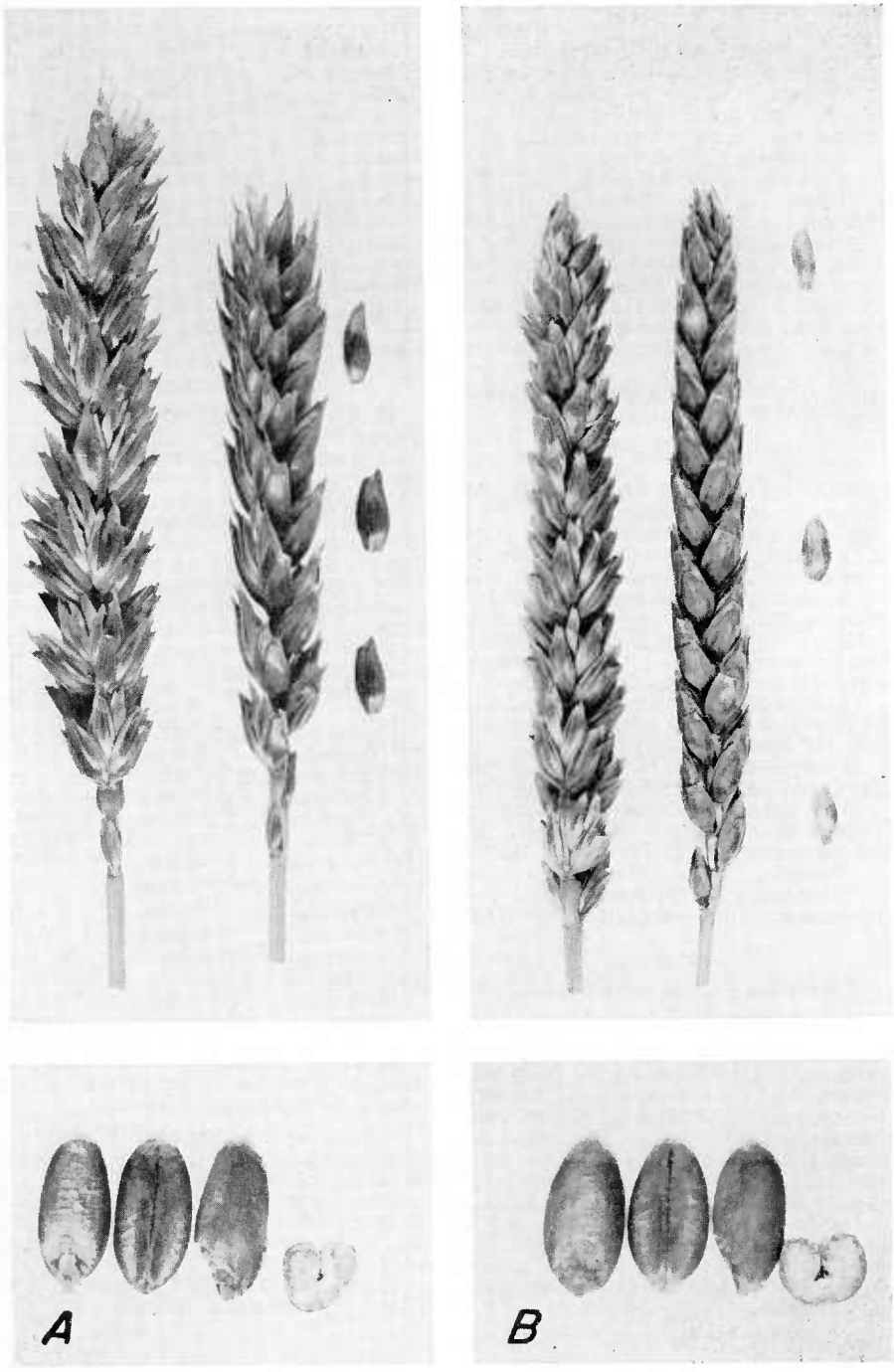

FIGURE 57.—*A*, Goldcoin and *B*, Federation wheats: Spikes and glumes, × 1; kernels, × 3.

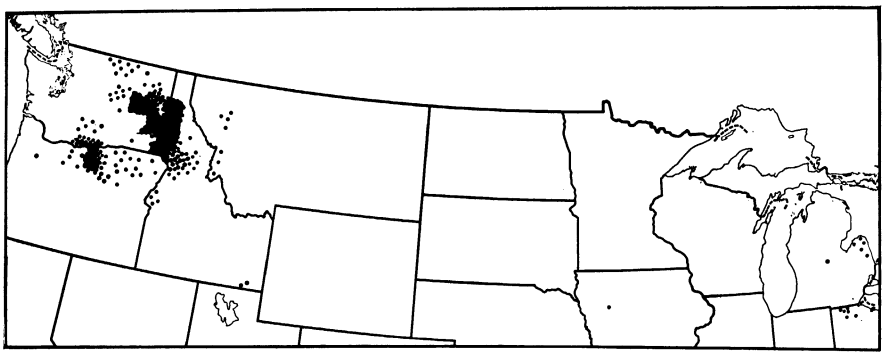

FIGURE 58.—Distribution of Golden and Goldcoin wheats in 1949. Estimated area, 593,877 acres.

GOLDEN

Description.—Golden differs from Goldcoin in being slightly later and in having shorter and stronger stems, more erect, dense, and clavate spikes. It is less easily shattered and is much more uniform.

History.—Seventy-five heads were selected from a field of Goldcoin at the Sherman Branch Experiment Station, Moro, Oreg., in 1923. After several years' tests selection No. 43, with kernels very similar to Goldcoin, was chosen as the best of the group. It was named Golden (C. I. 10063) (reg. 286) and was distributed to farmers in Union County and in Morrow County, Oreg., in 1930 and in Latah County, Idaho, in 1931.

Distribution.—Estimated area in 1949, 234,199 acres, grown in Oregon, Washington, and Idaho (fig. 58). Undoubtedly much of the acreage reported as Goldcoin in these States is Golden.

FEDERATION

Description.—Plant spring habit, early to midseason, short; stem white, strong; spike apically awnleted, oblong, dense, erect; glumes glabrous, brown, short, wide; shoulders wide, oblique to square; beaks narrow, acute, 0.5 mm. long; awnlets few, 1 to 3 mm. long; kernels white, usually short, soft, broadly ovate; germ midsized, crease usually narrow, shallow; cheeks rounded; brush midsized, midlong. (See fig. 57, *B*.)

Federation is a high-yielding variety in the western United States. Although a spring variety, it is fairly hardy and is fall-sown in mild climates.

History.—Federation (C. I. 4734) (reg. 77), according to Richardson (*171, reprint, pp. 124-126*):

> . . . was produced by the late Mr. Farrer, Wheat Experimentalist, of New South Wales [Australia], from a cross between Purplestraw [Australian] and Yandilla. Yandilla is a cross between Improved Fife and Etewah, an Indian variety. The production of this wheat was probably the greatest of Mr. Farrer's many triumphs in wheat breeding, for none of his many successful crossbred wheats have enjoyed such a wide measure of popularity as Federation.

Federation was first introduced into the United States by the United States Department of Agriculture (*211*, P. I. 38347) in 1914 from Western Australia. The variety first showed promise in nursery experiments at the Sherman Branch

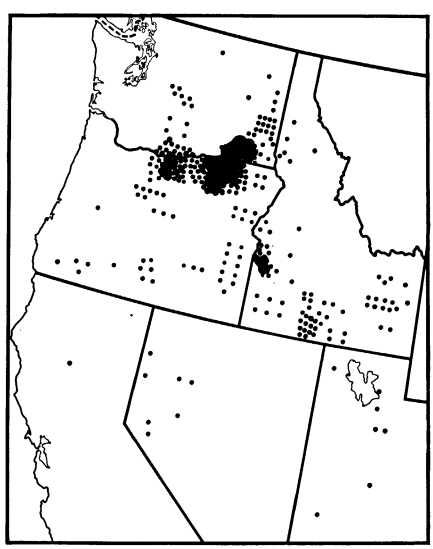

FIGURE 59.—Distribution of Federation wheat in 1949. Estimated area, 564,841 acres.

Experiment Station, Moro, Oreg., in 1916. The first distribution to farmers for commercial growing was from that station in the spring of 1920.

Distribution.—Estimated area in 1949, 564,841 acres, grown in six States (fig. 59).

FEDERATION 41

Description.—Federation 41 is resistant to several races of bunt, but is otherwise similar to Federation.

History.—Federation 41 (C. I. 12230) was developed by the California Agricultural Experiment Station at Davis by compositing 130 F_3 bunt-resistant lines grown in 1941 from the backcross (Martin × White Federation[3]) × Federation[6] (*201*). It was distributed in 1942 and probably comprises most of the acreage in California reported as Federation.

RAMONA 44

Description.—Plant spring habit, early, short; stem white, midstrong; spike awnless, fusiform to oblong, middense to lax, erect; glumes glabrous, brown, short, wide; shoulders wide, square; beaks midwide, obtuse, 0.5 mm. long; awnlets wanting; kernels white, midlong, semihard, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Ramona 44 is resistant to several races of bunt and of stem and leaf rust. It is about 3 days later than Ramona but is similar in morphological characters.

History.—Ramona 44 (C. I. 12390) was developed in the backcrossing program of the California Agricultural Experiment Station at Davis in cooperation with the Division of Cereal Crops and Diseases. It is a composite of 126 F_3 lines derived from (Martin × White Federation [3]) × Ramona [6] crossed on (Hope × White Federation [6]) × Ramona[3] grown in 1944. It was released in 1945 as Ramona 44.

Distribution.—Estimated area in 1949, 189,967 acres, grown in California, Arizona, and Nevada.

HARD FEDERATION

Description.—Plant spring habit, early, short; stem white, strong; spike awnless, oblong, dense, erect; glumes glabrous, brown, short, wide; shoulders wide, square; beaks narrow, acute, 0.5 mm. long; awnlets usually wanting; kernels white, short, hard, ovate, with truncate tip; germ large; crease midwide, middeep, frequently pitted; cheeks angular to rounded; brush large, midlong.

Hard Federation differs from Federation in being earlier and slightly shorter and in having curled flag leaves and hard kernels.

History.—Hard Federation (C. I. 4980) (reg. 79) was originated by selection from Federation in Australia. The following history was recorded (*4, p. 664*) in 1914:

> In consequence of the variations from ordinary type exhibited by the strain of Federation wheat now being grown at Cowra Experiment Farm, it has been deemed advisable to apply a distinct name to it, and Hard Federation has been selected as the most appropriate. The departure from type was first noticed by Mr. J. T. Pridham, Plant Breeder, in 1907 or 1908, one of the plants selected from the stud plots being observed to thresh grain of remarkably hard and flinty appearance. The plant had the distinctive brown head and general appearance of Federation in the field, but the grain was of a class that had never been seen in this variety before. The seed was propagated, and in 1910 the occurrence of white heads was noticed, and from then till 1912 distinctly white heads were common among the brown, but in 1913 there were no white-eared plants, and it is hoped that the seed will now be true to type.

Hard Federation was introduced from New South Wales, Australia, in August 1915, by the United States Department of Agriculture (*211*, P. I. 41079). It was first grown at the Sherman Branch Experiment Station, Moro, Oreg., in 1916. Experiments conducted in Oregon and California from 1917 to 1919 (*56*) showed it to be a high-yielding, dry-land wheat. It was distributed for commercial growing in 1920.

Distribution.—Estimated area in 1949, 34,025 acres, grown in four States, Oregon, Washington, Idaho, and Montana.

HARD FEDERATION 31

Description.—This selection differs from Hard Federation in having slightly taller, stronger, and more glaucous stems, in being more uniform in time of heading and height, and in being later.

History.—Hard Federation 31 (C. I. 8255) (reg. 288) proved to be the best of 85 head selections made from a field of Hard Federation on the Sherman Branch Experiment Station, Moro, Oreg., in 1921. It was distributed for growing in the Grande Ronde Valley of eastern Oregon in 1928, where it has replaced the Hard Federation variety.

Distribution.—It is likely that most of the acreage reported as Hard Federation is really Hard Federation 31.

MOKING

Description.—Plant winter habit, early to midseason, midtall; stem white, midstrong; spike awnleted, fusiform, dense, inclined; glumes glabrous, brown, midlong, midwide to wide; shoulders midwide to wide, square to rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 3 to 10 mm. long; kernels red, short, soft, broadly elliptical; germ midsized; crease midwide, shallow; cheeks rounded; brush midsized, midlong.

Moking differs from Clarkan in having brown chaff and slightly weaker straw. It is resistant to flag smut.

History.—Moking (C. I. 12556) was developed by the private breeder, Earl G. Clark, of Sedgwick, Kans. The parentage is unknown, but its resemblance to Clarkan suggests that variety as one parent. It was distributed in 1946 as Clark's 40R169 and later named Moking.

Distribution.—Estimated area in 1949, 2,200 acres, grown in Oklahoma.

RED WAVE

Description.—Plant winter habit, midseason to late, midtall to tall; stem white, midstrong; spike awnleted, broadly fusiform, middense, nodding; glumes glabrous, brown, midlong, wide; shoulders wide, rounded to oblique, sometimes nearly square; beaks wide, obtuse, 1 mm. long; awnlets several, 5 to 15 mm. long; kernels red, midlong, soft, ovate; germ midsized; crease midwide to wide, middeep, sometimes pitted; cheeks usually angular; brush midsized, midlong.

History.—Red Wave (C. I. 3500) (reg. 82) originated by A. N. Jones, Le Roy, Genesee County, N. Y., in 1906 as the result of a cross between Early Red Clawson and an unnamed crossbred wheat of Russian parentage (*98, 1910 issue*).

Distribution.—Estimated area in 1949, 10,290 acres, grown in six States.

Synonyms.—Indiana Red Wave, Jones Red Wave.

PURDUE NO. 1

Description.—Plant winter habit, midseason, midtall; stem white, midstrong to strong; spike awnleted, oblong, middense, erect to inclined; glumes glabrous, brown, sometimes with black stripes, midlong, midwide; shoulders wide, rounded to square; beaks midwide, obtuse, 0.5 mm. long; awnlets several to many, 5 to 25 mm. long, partly incurved; kernels light red, midlong, soft, elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, short.

Purdue No. 1 is somewhat resistant to leaf rust but is susceptible to mosaic, flag smut, and loose smut. It is also resistant to winterkilling by both low temperature and heaving.

History.—Purdue No. 1 (C. I. 11380) is from a cross between Michigan Amber and Rudy made at the Purdue University Agricultural Experiment Station, Lafayette, Ind., in 1909. The selection that resulted in Purdue No. 1 was made in 1925. It was first grown on farms in 1934.

Distribution.—Estimated area in 1949, 1,148 acres, grown in Indiana.

CURRELL

Description.—Plant winter habit, early to midseason, midtall; stem usually purple, midstrong; spike awnleted, fusiform, middense, inclined; glumes glabrous, brown, midlong, narrow to midwide; shoulders midwide, oblique to square; beaks usually wide, sometimes nearly wanting, 0.5 mm. long; awnlets few, 3 to 10 mm. long; kernels dull red, short to midlong, soft, ovate; germ midsized; crease narrow to midwide, shallow to middeep, distinctly triangular; cheeks usually rounded; brush small, midlong. (See fig. 60, *A*.)

History.—The history of Currell (C. I. 3326) (reg. 90) has been recorded by Carleton (*37, p. 202*) as follows:

> Currell Prolific wheat was selected by W. E. Currell, of Virginia, from a field of Fultz in 1881. The original seed was from three spikes. In 1884 it was first sold for seed.

Distribution.—Estimated area in 1949, 87,891 acres, grown in eight States, the largest acreages being in Missouri, Kentucky, and Tennessee.

Synonyms.—Currell's Prolific, Dunbar, Gill, Golden Chaff, Pearl Prolific, Perfection, Prolific, Red Gill, Red Prolific, Tennessee Prolific.

BALDROCK

Description.—Plant winter habit, midseason, midtall to tall; stem purple, midstrong to strong; spike awnleted, fusiform, middense, inclined to nodding; glumes glabrous, brown, midlong, midwide; shoulders wide, oblique to rounding; beaks midwide, obtuse, 0.5 mm. long; awnlets few, 3 to 12 mm. long; kernels red, midlong, soft, elliptical; germ midsized; crease wide, deep; cheeks angular; brush midsized, midlong.

History.—Baldrock (C. I. 11538) (reg. 271) was produced (*71*) by the Michigan Agricultural Experiment Station, East Lansing, from a field hybrid between

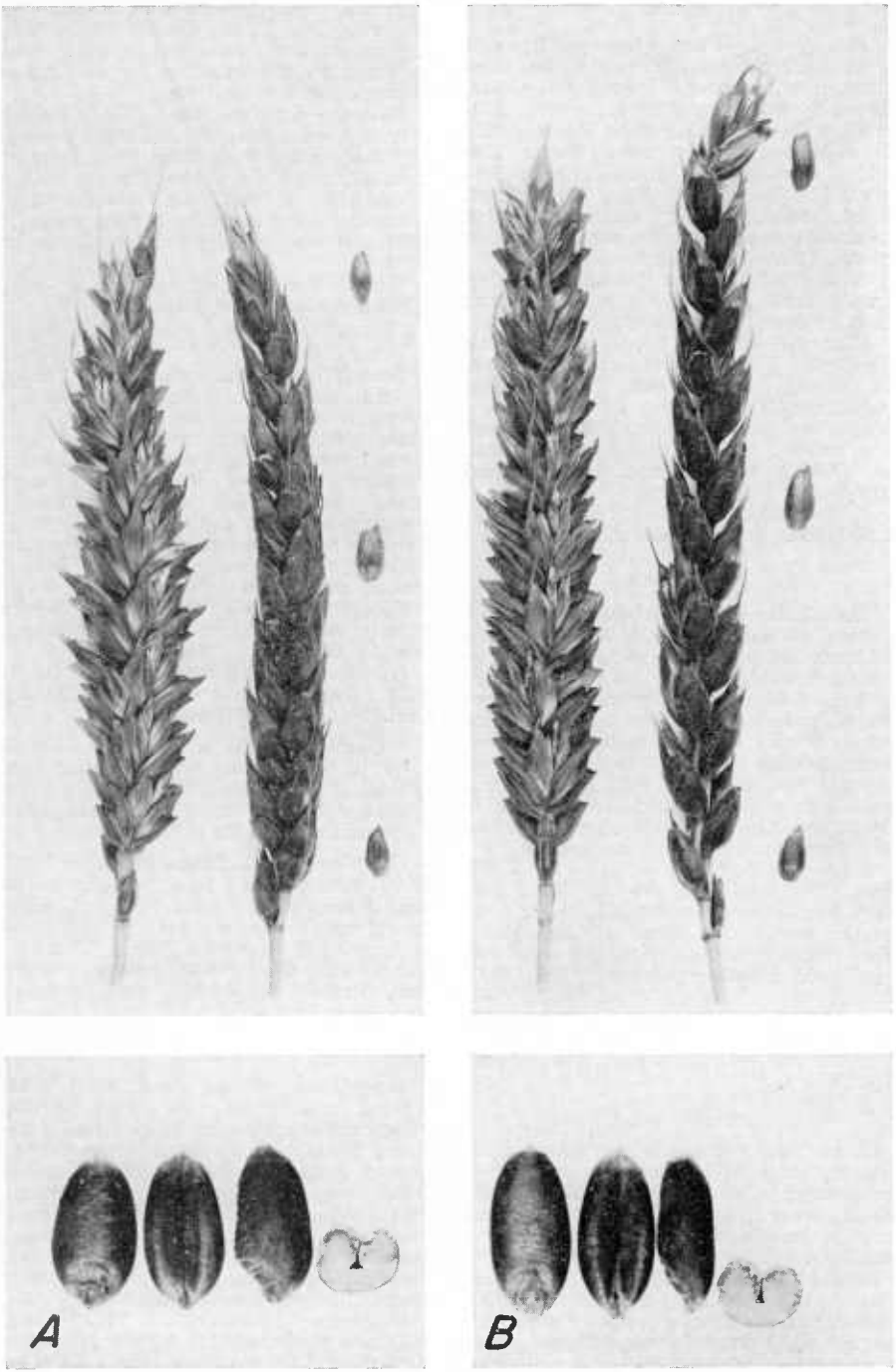

FIGURE 60.—*A*, Currell and *B*, Poole wheats: Spikes and glumes, × 1; kernels, × 3.

Red Rock and an unknown variety. Many awnless selections were made from these hybrids and tested from 1917 to 1922. Baldrock is one of these strains. It was increased and 145 bushels were distributed to farmers in 1931.

Distribution.—Estimated area in 1949, 10,149 acres, grown in Michigan.

POOLE

Description.—Plant winter habit, midseason, midtall; stem purple, midstrong; spike awnleted, usually fusiform, sometimes nearly oblong or linear oblong, wide, middense to lax, usually nodding; glumes glabrous, brown, midlong, wide; shoulders wide, oblique to square; beaks wide, obtuse, 0.5 mm. long; awnlets several, 5 to 20 mm. long; kernels red, midlong, soft, ovate to oval, frequently elliptical, flattened; germ small to midsized; crease midwide, middeep to deep; cheeks usually rounded; brush small to midsized, midlong.

Poole is distinguished from Red Wave by its purple stems. The kernels are rather narrow, flattened, and rounded in outline. (See fig. 60, *B*.)

History.—The origin of Poole (C. I. 3488) (reg. 92) is undetermined, but it has been an important variety in Ohio and Indiana since about 1880. It was grown by the Ohio Agricultural Experiment Station as early as 1884 (*130, p. 15*).

Harvest King was distributed by J. A. Everitt & Co. (*76*), seedsmen, of Indianapolis, Ind., from 1894 to about 1900. There is no information regarding the origin of the variety, and it probably is only a lot of seed of the Poole variety. As the wheat was widely advertised under this name, it is now grown nearly as widely as Harvest King and other names as under the name "Poole."

Distribution.—The estimated area in 1949, was 44,122 acres, grown in 12 Eastern States.

Synonyms.—Beechwood, Harvest King, Hedge Prolific, Hundred Mark, Mortgage Lifter, Nissley, Red Amber, Red Chaff, Red Fultz, Red King, Red Russell, Winter King.

RUSSIAN RED

Description.—Russian Red differs slightly from Poole in having more persistent glumes that have more triangular shoulders and longer beaks (1 to 1.5 mm. long).

History.—Russian Red (C. I. 5928) (reg. 94) usually is grown under the name "Red Russian," but as other varieties are known by this name it is here designated as Russian Red. The following history of this wheat was reported by E. H. Collins (*61, p. 7*), who was offering the seed for sale in 1898:

> In answers to questions allow me to say that the Red Russian wheat I advertise in the *Farmer* was selected by an agent sent by the American Seed Co., of Rochester, N. Y., to Russia to secure their best wheat. It was introduced in this section by a prominent mill in Indianapolis * * *.

This variety was grown by the Ohio Agricultural Experiment Station as early as 1888 (*102, p. 29*). It was distributed widely by Peter Henderson & Co. (*98*), seedsmen, of New York City, and J. A. Everitt & Co. (*76*), seedsmen, of Indianapolis, Ind., in the early nineties.

Distribution.—Estimated area in 1949, 335 acres, grown in Missouri.

PURCAM

Description.—Plant winter habit, early, short; stem purple, midstrong to strong; spike awnleted, oblong, middense to dense, erect; glumes glabrous, brown, short to midlong, midwide; shoulders midwide, oblique; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 5 to 25 mm. long; kernels red, short, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized to large, midlong.

Purcam is a very early variety with a winter habit of growth, short stiff straw, and high resistance to leaf rust. It has satisfactory soft-wheat quality but is very susceptible to loose smut and mosaic.

History.—Purcam (C. I. 12295) was developed by the Purdue Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross made in 1932 between Purplestraw and a selection from a cross (2758A1–3–14) between Chinese (C. I. 6223) and Michigan Amber. Indiana selection 3217–29, an F_7 selection made in 1937, was one of several sent to Arlington Experiment Farm in Rosslyn, Va., in 1940. After showing promise at Arlington Farm and Beltsville, Md., it was included in the Uniform Southern Wheat Nursery in 1943 and named Purcam. It was distributed by the Clemson Agricultural Experiment Station in South Carolina in the fall of 1951.

RED MAY (MICHIGAN AMBER)

Description.—Plant winter habit, midseason, midtall to tall; stem purple, midstrong; spike awnleted, usually oblong, middense, erect to inclined; glumes glabrous, brown, short to midlong, wide;

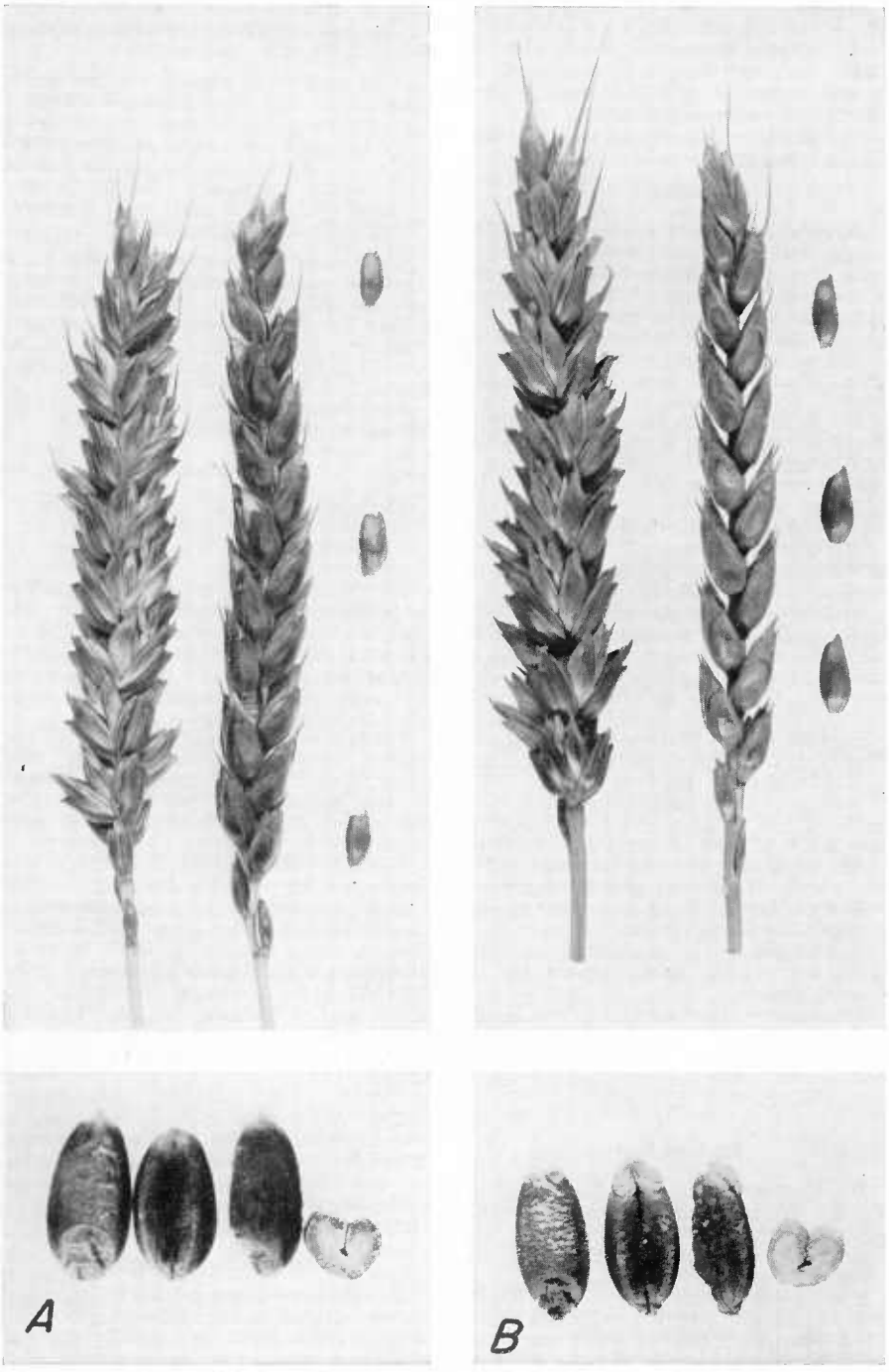

FIGURE 61.—*A*, Red May and *B*, Thorne wheats: Spikes and glumes, × 1; kernels, × 3.

shoulders wide, usually square; beaks narrow, triangular, 0.5 mm. long; awnlets few, 3 to 15 mm. long; kernels red, usually short, soft, ovate; germ midsized; crease midwide to wide, middeep to deep; cheeks usually angular; brush usually small, midlong.

Red May differs from Poole in being earlier and in having a broader and more oblong spike and wider glumes with squarer shoulders. (See fig. 61, *A*.)

History.—Red May (C. I. 5336) (reg. 97) is believed to be identical with or descended from the Red or Yellow Lammas. Several writers have suggested the identity. Tracy (*210*) mentions Yellow Lammas as being a synonym of Red May. Lammas was mentioned by Körnicke and Werner (*126, pp. 253, 290*) as being a very old English wheat grown prior to 1699. Both the Red and Yellow Lammas were grown in Virginia many years before the Revolutionary War. A white May wheat of a later period, according to Cabell (*32, p. 14*), was grown in Virginia as early as 1764. A more recent history of Red May indicates that it was originated by General Harmon from the Virginia White May (a white-kerneled wheat) about 1830 (*92, p. 226*). This wheat has been grown quite widely under the name "Red May" since 1845.

Although more commonly used, especially in Indiana, the name Michigan Amber seems to be of a later date than Red May and for that reason the latter is preferred. The writers' samples of the variety are similar to Red May, with the possible exception of being a few days later in maturity. This might be easily owing to the fact that Michigan Amber wheat has been grown farther north than the Red May since about 1870.

Michigan Wonder is the name under which the variety is grown in Missouri. It was reported as one of the highest yielding wheats at the Missouri Agricultural Experiment Station in 1911 (*145, p. 211*). The writers' specimens are the same as Red May, except that the heads are slightly more erect.

Orange wheat was reported as having been introduced into Monroe County, N. Y., from Virginia in 1846 (*93, p. 286*). In 1858 Klippart (*124*) reported Orange wheat as a beardless, white-grained winter wheat grown in Ohio. The wheat now grown as Orange, however, has red kernels and apparently is identical with Red May. It was reported as one of the excellent-yielding awnless varieties of wheat for Missouri in 1910 (*66, p. 67*). For a more complete history of the synonyms of Red May, see Technical Bulletin 459 (*43*).

Distribution.—Estimated area in 1949, 139,723 acres, grown in 12 States.

Synonyms.—Beechwood, Early May, Jones Longberry, May, Michigan Amber, Michigan Wonder, Orange, Purdue No. 4, Red Amber, Red Republic.

THORNE

Description.—Plant winter habit, midseason, midtall; stem faint purple, midstrong to strong; spike awnleted, oblong to fusiform, middense, erect to inclined; glumes glabrous, brown, midlong, midwide; shoulders midwide, oblique; beaks wide, obtuse, wanting to 0.5 mm. long;

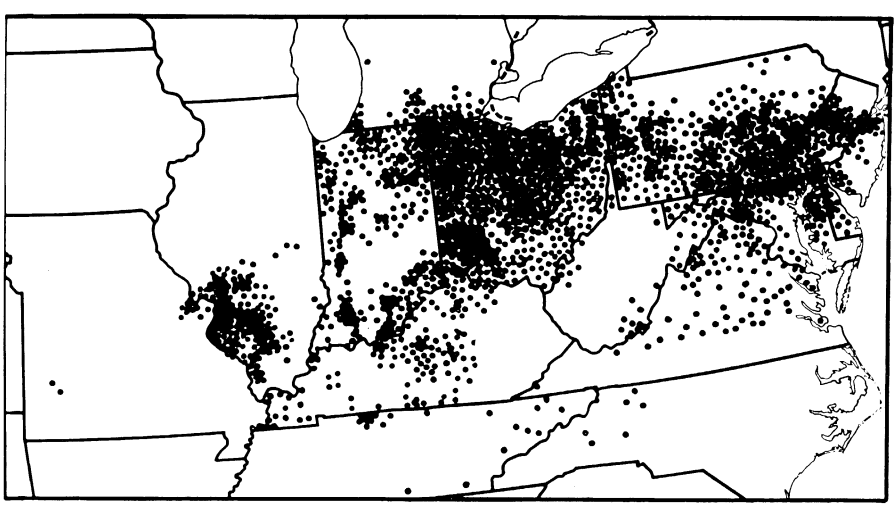

FIGURE 62.—Distribution of Thorne wheat in 1949. Estimated area, 3,447,661 acres.

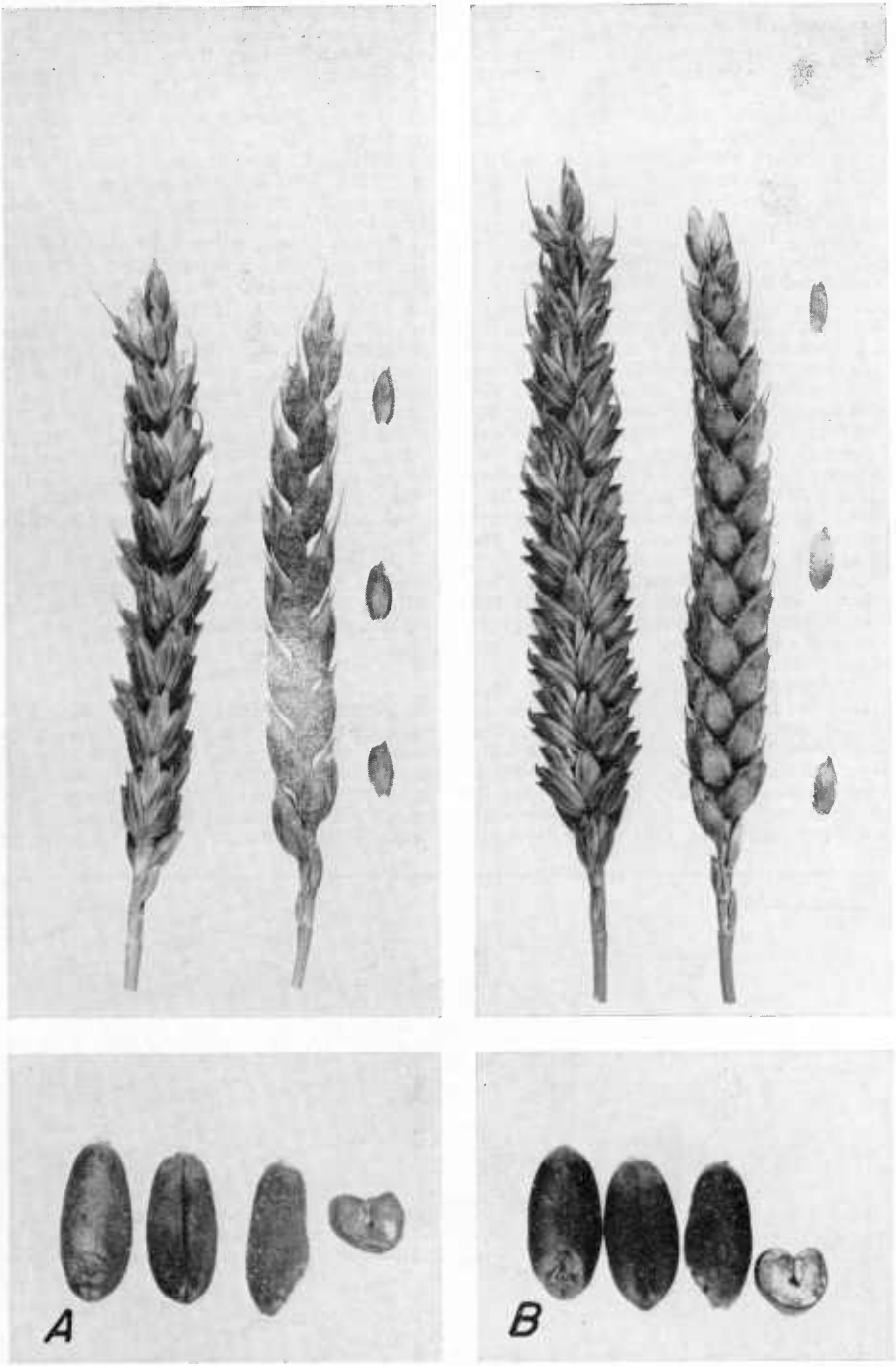

FIGURE 63.—*A*, Red Chief and *B*, Triplet wheats: Spikes and glumes, × 1; kernels, × 3.

awnlets several, 5 to 25 mm. long; kernels red, midlong, soft, elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong. (See fig. 61, *B*.)

Thorne is resistant to the races of loose smut commonly found in Ohio. It has very stiff straw and is resistant to mosaic. It is a high-yielding variety of good soft-wheat quality, although it is somewhat low in weight per bushel.

History.—Thorne (C. I. 11856) (reg. 323) was bred from a cross between Portage and Fulcaster made at the Ohio Agricultural Experiment Station at Columbus, in 1917. The bulk material was taken to the experiment station at Wooster, Ohio, where the selection that resulted in Thorne was made in 1922. It was carried as T. N. 1006 until 1936, when it was reselected and increased under the name "Thorne." Seed was distributed to a select group of farmers for increase in the fall of 1937 (*128*).

Distribution.—Estimated area in 1949, 3,447,661 acres (fig. 62). It is the leading soft-wheat variety.

Synonym.—T. N. 1006.

SENECA

Description.—Seneca is very similar to Thorne. It has a higher test weight, a slightly higher yield, and a slightly stiffer straw.

History.—Seneca (C. I. 12529) (Ohio T. N. 1016–4) was developed at the Ohio Agricultural Experiment Station. It is a sister selection of Thorne. After thorough testing it was increased on a few acres in 1949, and several thousand bushels were distributed from the 1950 harvest.

ANDERSON

Description.—Plant intermediate habit, midseason, midtall to tall; stem white, midstrong to strong; spike awnleted, oblong, lax, inclined; glumes glabrous, brown, long, midwide; shoulders narrow, rounded; beaks midwide, obtuse, 0.5 mm. long; kernels red, midlong to long, soft, elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong.

Anderson is resistant to leaf rust, but it is susceptible to stem rust and moderately susceptible to mosaic. It averages less than the Atlas strains in protein content but is somewhat higher than many other varieties grown in the South. Its quality is satisfactory for the medium-strength soft wheat flour.

History.—Anderson (C. I. 12536) was developed from a cross between Leapland and Fronteira made at Arlington Farm, Rosslyn, Va., by the Division of Cereal Crops and Diseases. Selection was continued at Beltsville, Md. Selection Y2652, later named Anderson, was entered in the Uniform Southern Wheat Nursery in 1947. It showed promise and was distributed in South Carolina in the fall of 1951. It was distributed in North Carolina in the fall of 1952.

RED CHIEF

Description.—Plant winter habit, early, midtall; stem white, midstrong; spike awnleted, fusiform, dense, erect; glumes glabrous, brown and black, short, midwide; shoulders narrow, rounded; beaks midwide, obtuse, 0.5 mm. long; awnlets several, 3 to 15 mm. long; kernels red, midlong, hard, broadly elliptical; germ midsized; crease midwide, shallow; cheeks rounded; brush midsized, midlong. (See fig. 63, *A*.)

Red Chief is somewhat similar to Chiefkan but has brown pigment along with black in the glumes and has stronger straw. The grain is also darker in color than Chiefkan and somewhat higher in test weight. It is poor in bread-baking quality.

History.—Red Chief (C. I. 12109) resulted from a vigorous awnless plant selected from a field of Blackhull wheat by Earl G. Clark, a farmer wheat breeder

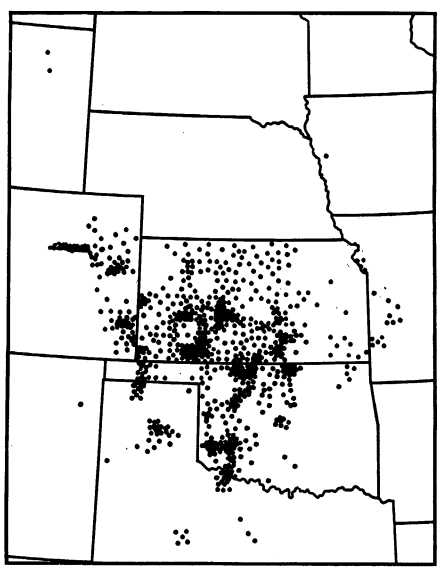

FIGURE 64.—Distribution of Red Chief wheat in 1949. Estimated area, 1,160,893 acres.

of Sedgwick, Kans. It was increased and distributed by him in 1940 (*101*).

Distribution.—Estimated area in 1949, 1,160,893 acres (fig. 64).

Synonyms.—Deluxe Red Chief, Superred, Super Red Chief.

TRIPLET

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, oblong to fusiform, middense, inclined; glumes pubescent, white, midlong, midwide; shoulders midwide, oblique to square; beaks wide, obtuse, 0.5 to 1 mm. long; awnlets several, 3 to 12 mm. long, sometimes incurved throughout spike; kernels red, short to midlong, semihard, ovate; germ small; crease narrow to midwide, shallow; cheeks rounded; brush small, midlong. (See fig. 63, *B.*)

Triplet differs from Jones Fife in being slightly shorter and earlier and in having a harder kernel with a smaller germ and rounded rather than angular cheeks.

History.—Triplet (C. I. 5408) (reg. 108) was originated at the Washington Agricultural Experiment Station, Pullman. Its pedigree is as follows:

(Jones Fife × Little Club) × (Jones Fife × Turkey)

It was first grown as a pure strain in 1910 and was distributed for commercial growing in 1918.

Distribution.—Estimated area in 1949, 44,248 acres, grown in Washington, Idaho, and Montana.

JONES FIFE

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awnleted, oblong to fusiform, middense, nodding; glumes pubescent, white, midlong, midwide to wide; shoulders midwide, oblique to square; beaks wide, obtuse, 0.5 to 1 mm. long; awnlets few to several, lower ones often incurved, 3 to 8 mm. long; kernels red, short to midlong, soft, ovate, humped; germ midsized; crease midwide to wide, middeep to deep; cheeks angular; brush midsized, midlong.

History.—Jones Fife (C. I. 4468) (reg. 110) was originated by A. N. Jones, of Newark, Wayne County, N. Y., in 1889.[11] According to Carleton (*37, p. 221*), it "descended from Fultz, Mediterranean, and Russian Velvet."

Crail Fife is a local name applied to Jones Fife wheat in Montana, Frank Crail, of Bozeman, Mont., being the farmer who grew and distributed the variety under that name. Burbank's Super, or Super wheat, was distributed by Luther Burbank, of Santa Rosa, Calif., in the fall of 1917. Apparently most of his stock was purchased and resold by the State Seed & Nursery Co., of Helena, Mont. The writers have found Super wheat to be identical with Jones Fife in all taxonomic characters, as well as in yield and in milling and baking quality.

Distribution.—Estimated area in 1949, 20,064 acres, grown in Idaho, Illinois, Kentucky, Oregon, Tennessee, and Washington.

Synonyms.—Burbank's Super, Crail Fife, Fife, Fishhead, Jones Winter Fife, Silver King, Super, Velvet Chaff, Winter Fife.

REWARD

Description.—Plant spring habit, early, short to midtall; stem white, midstrong but easily crinkled at the nodes; spikes awnleted, fusiform, middense, erect to inclined; glumes pubescent, white, sometimes black-striped, short, midwide; shoulders midwide, oblique to elevated; beaks wide, acute, triangular, 0.5 to 1 mm. long; awnlets several, sometimes black, 5 to 15 mm. long; kernels red, short to midlong, hard, ovate; germ midsized; crease midwide, middeep; cheeks rounding to angular; brush midsized, short. (See fig. 65, *A.*)

Reward is very early and has a high test weight and good quality for breadmaking.

History.—Reward (C. I. 8182) (reg. 261) was developed from a cross between Marquis and Prelude made in 1912 at the Central Experimental Farm, Ottawa, Canada. It was distributed for commercial growing in Canada in 1928. Reward was first introduced into the United States from Canada by commercial growers in 1928 (*150*).

Distribution.—Estimated area in 1949, 98,271 acres grown in seven States, the largest acreages being in Montana, Colorado, and South Dakota.

GALGALOS

Description.—Plant spring habit, although remaining prostrate during its early growth, midseason, midtall; leaves pubescent, glaucous; stem white, slender, weak; spike awnleted, fusiform, lax, inclined; glumes pubescent, light brown, long, midwide; shoulders midwide, oblique to square; beaks wide, acute, 1 to 2 mm. long; awnlets many, 3 to 30 mm. long; kernels white, midlong, soft, ovate to elliptical, slightly humped, ventral side rounded; germ small; crease narrow,

[11] Printed stationery of A. N. Jones.

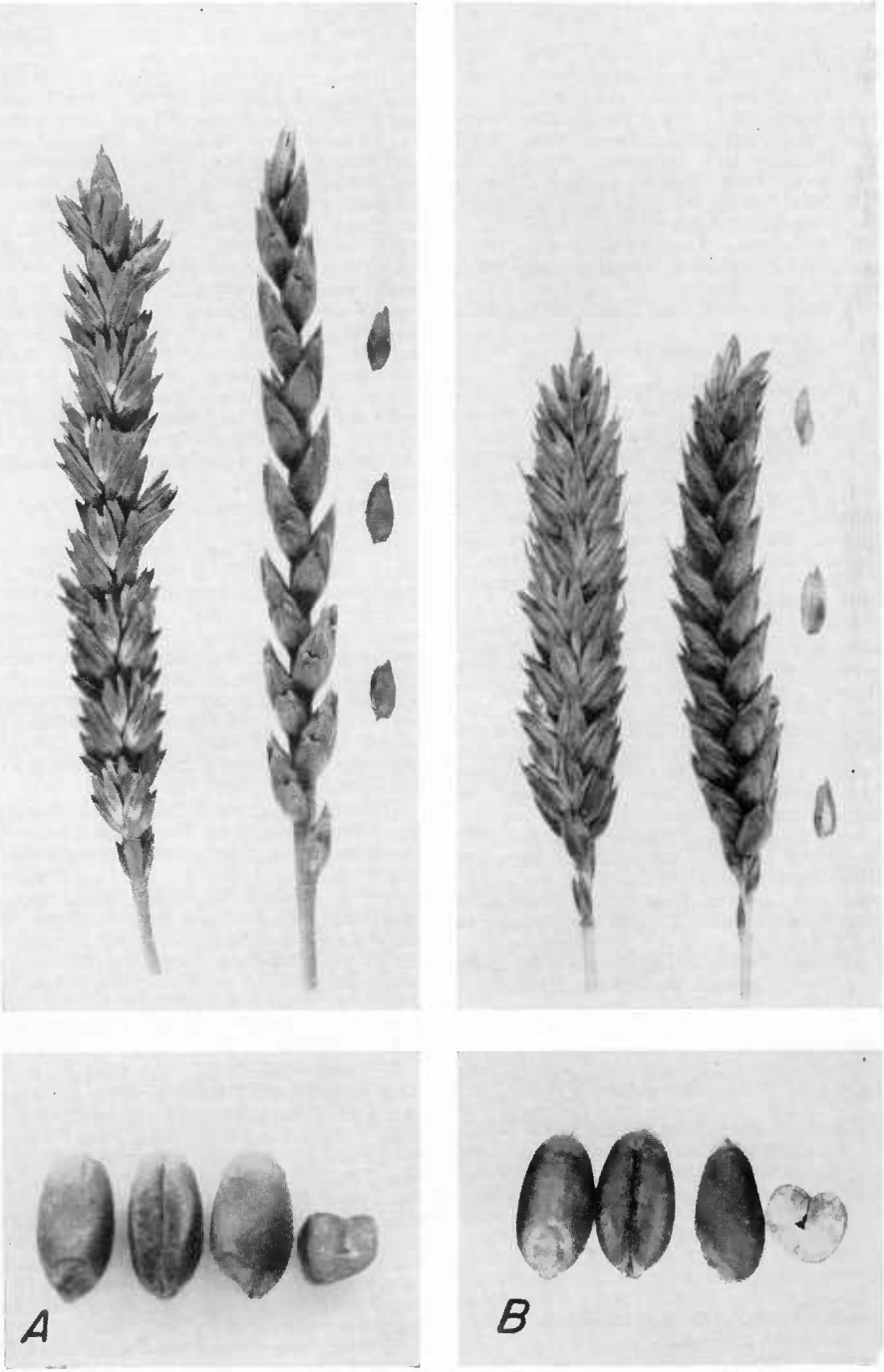

FIGURE 65.—*A*, Reward and *B*, Sonora wheats: Spikes and lumes, × 1; kernels, × 3.

shallow; cheeks usually rounded; brush midsized, midlong.

History.—Galgalos (C. I. 2398) (reg. 113) (P. I. 9872) was introduced in 1903 by the United States Department of Agriculture (*211*) from the Erivan Government in Transcaucasian Russia. Seed of Galgalos was increased by E. M. Smith of Hay Creek, Oreg., from a sample sent him from the United States Department of Agriculture in 1904.

Distribution.—Estimated area in 1949, 40,377 acres, grown in Oregon, California, Nevada, and Utah.

Synonyms.—Russian Red, Velvet Chaff.

SONORA

Description.—Plant spring habit, early, short to midtall; stem white, weak; spike awnleted, oblong, short, dense, erect, easily shattered; glumes pubescent, brown, midlong, midwide; shoulders narrow, usually oblique; beaks narrow, acuminate, 1 to 3 mm. long; awnlets several, 3 to 8 mm. long; kernels white, short, soft, ovate to oval; germ small; crease midwide, shallow; cheeks rounded; brush small, short. (See fig. 65, *B*.)

History.—Sonora (C. I. 3036) (reg. 114) was brought to the United States from Magdalena Mission, in northern Sonora, Mexico, where it has been grown since about 1770.[12] It is known to have been grown in the United States since about 1820. Several samples of wheat, similar to Sonora, have been introduced by the United States Department of Agriculture from South Africa.

Sonora 37, a bunt-resistant strain, was developed by the California Agricultural Experiment Station by backcrossing bunt-resistant lines of Sonora × Martin to Sonora six times. It was distributed in 1937.

Distribution.—Estimated area in 1949, 2,285 acres, grown in Arizona, California, New Mexico, and Utah.

Synonyms.—Ninety-Day, Red Chaff, White Sonora.

AWNED ONAS

Description.—Plant spring habit, early to midseason, short to midtall; stem white, strong; spike awned, oblong, dense, erect; glumes glabrous, white, short to midlong, wide; shoulders midwide, rounded to elevated; beaks narrow, acuminate, 8 to 12 mm. long; awns 3 to 6 cm. long; kernels white, short to midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush small, midlong.

[12] Verbal statement of W. W. Mackie, Jan. 22, 1919.

The variety is similar to Onas except in being awned and in having a higher test weight.

History.—Awned Onas (C. I. 12235) was derived from Baart × Onas backcrossed 8 and 9 times to Onas to transfer the awns of Baart to Onas. The material was grown at Tucson, Ariz., and Aberdeen, Idaho, during the making of the first 6 backcrosses. The additional backcrosses were made at Davis, Calif., beginning in 1938, and the final composite of 24 F_3 lines was made at that station. The work was cooperative between the Division of Cereal Crops and Diseases and the Arizona, Idaho, and California Agricultural Experiment Stations (*202*). Bulk seed was distributed in Arizona in the fall of 1950. Approximately 1,000 head rows were grown in Arizona in 1950. The offtype rows were discarded and seed of the remainder bulked for foundation seed.

ORFED

Description.—Plant spring intermediate habit, early, if fall-sown, late if spring-sown, short to midtall; stem white, strong; spike awned, oblong, dense, erect; glumes glabrous, white, short to midlong, narrow; shoulders narrow, wanting to square; beaks narrow, acuminate, 8 to 15 mm. long; awns 5 to 8 cm. long; kernels white, midlong, soft to semihard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 66, *A*.)

Orfed is resistant to most races of bunt but is susceptible to T–16 and L–8. It is resistant to flag smut. It has stiff straw which is rather fine and wiry. Orfed is moderately hardy when sown late in the fall, but also may be grown in some areas as a spring variety if seeded early. Its milling qualities are only fair. Its baking qualities for cakes or bread, depending on protein content, are good. It is a soft-textured wheat with a strong gluten.

History.—Orfed (C. I. 11913) (reg. 339) was selected from a cross between Oro and Federation made in 1931 at the Idaho Agricultural Experiment Station at Moscow. The F_2 was grown at the Washington Agricultural Experiment Station at Pullman in 1933. Seed for the third generation was inoculated with several races of bunt. Smut-free plants resistant to lodging and shattering were selected in 1934. Seed of selection 80, Wash. No. 3300, was named Orfed and released to growers in 1943 (*216*).

Distribution.—Estimated area in 1949, 182,652 acres, grown in Washington, Oregon, and Idaho.

FIGURE 66.—*A*, Orfed and *B*, Baart wheats: Spikes and glumes, × 1; kernels, × 3.

BAART

Description.—Plant spring habit, early to midseason, midtall to tall; stem white, weak; spike awned, fusiform, middense, inclined; glumes glabrous, white, long, narrow; shoulders narrow, oblique to square; beaks 3 to 5 mm. long; awns 3 to 6 cm. long; kernels white, long, semihard, ovate; germ small; crease narrow, shallow; cheeks usually rounded; brush midsized, short to midlong. (See fig. 66, *B*.)

Baart can be distinguished from all others by the large yellowish pear-shaped kernels.

History.—Baart (C. I. 1697) (reg. 123) was received as Early Baart with four other varieties (*211*, P. I. 5078) from Australia by the United States Department of Agriculture in 1900. In Australia it has never been a leading commercial variety, although it has been grown by some farmers for many years. The variety was introduced to Australia from the Cape Colony, South Africa, about 1880 (*185*).

Neethling, 1932 (*147*, *p. 33*), stated that "Baard" wheat was mentioned in South African literature as early as 1739 and suggests that the original stock may have been introduced from western Europe.

In the United States the variety was first distributed for commercial growing by the Arizona Agricultural Experiment Station, which obtained its original seed from the then Office of Cereal Investigations, United States Department of Agriculture. The variety was well established in Arizona in 1914, when it was first grown in Washington from seed from Arizona; it later spread to Oregon and Idaho and to California about 1917.

Distribution.—The estimated area of Baart in 1949 was 504,268 acres (fig. 67).

Synonym.—Early Baart.

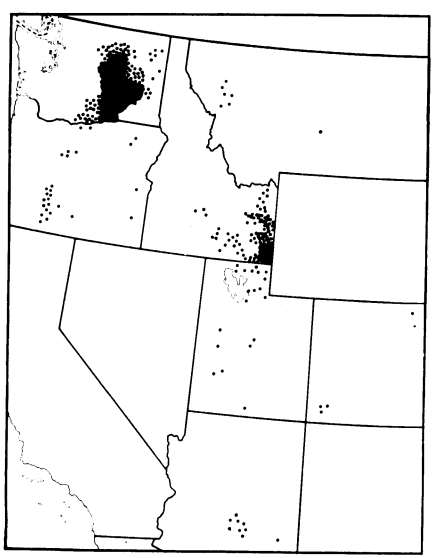

FIGURE 67.—Distribution of Baart wheat in 1949. Estimated area, 504,268 acres.

BAART 38

Description.—This variety is very similar to Baart except in being resistant to some races of stem rust and bunt.

History.—This strain (C. I. 11907) of Baart was developed in cooperative investigations of the California Agricultural Experiment Station and the Division of Cereal Crops and Diseases at Davis, Calif. A program was begun in 1922 to develop, by backcrossing, strains of the important commercial wheat varieties in California that would be resistant to bunt. Later a similar project was begun to add stem rust resistance to the most important varieties. Baart 38 is the result of backcrossing Martin × Baart 6 times with Baart to obtain a bunt-resistant Baart and backcrossing Hope × Baart 4 times with Baart to obtain a rust-resistant Baart (*201*). Each backcross was made on segregates resistant to bunt or stem rust, depending on the cross. The bunt-resistant and stem-rust-resistant strains were then crossed and 157 of the F_3 segregates resistant to both diseases were bulked and increased in 1938. The variety was distributed to growers in the fall of 1939.

Distribution.—Estimated area in 1949, 154,060 acres, of which 153,263 were in California and Arizona.

BAART 46

Description.—Baart 46 is similar to Baart in morphologic characters. As a result of rigid selection, it is more resistant than Baart 38 to stem rust. It is resistant to some races of bunt.

History.—Baart 46 (C. I. 12386) was developed in the backcrossing program of the California Agricultural Experiment Station, at Davis, in cooperation with the Division of Cereal Crops and Diseases. Thirteen of the original 182 lines composited to make Baart 38 were backcrossed twice to Baart and the progenies selected for rust resistance from F_2 to F_5 segregates. Forty-five F_5 lines were composited in 1946 and increased and distributed in the fall of 1948.

GLADDEN

Description.—Gladden is similar to Gypsy, but can be distinguished from it by its shorter beaks, which usually do not exceed 3 mm. It also has stronger stems and is superior to Gypsy in yield and quality.

History.—The following history of Gladden (C. I. 5644) (reg. 126) has been reported by C. G. Williams (*230, p. 3*), of the Ohio Agricultural Experiment Station, where the variety was originated.

> The Gladden wheat originated from a single head of wheat selected from a field of Gypsy wheat in 1905, and was first grown in 1906 under the number 6100, along with other headrows of Gypsy, Fultz, Poole, and other varieties.
>
> In consulting the old notebook of 14 years ago I find it described as "very erect" in growth, the words being underscored, and given the highest rank for stiffness of straw of any of the Gypsy rows, and as high a rank as any row in the test. The photographs taken in 1907, 1910, and 1915 show more than ordinary stiffness of straw.
>
> This variety passed along under the number name "6100" until 1915, when it seemed best to give it a real name in order to prevent confusion, as it was being distributed quite a little over the State. It was named for Washington Gladden, a man not associated with agriculture particularly, but the most useful citizen Ohio had for many years.

Distribution.—Estimated area in 1949, 23 acres, grown in Ohio.

Synonym.—Number 6100.

SALINE

Description.—Plant winter habit, midseason, midtall; stem white, strong; spike awned, oblong, middense to dense, inclined; glumes glabrous, white, midlong, narrow to midwide; shoulders narrow, rounded to elevated; beaks midwide, acute, 2 to 3 mm. long; awns 5 to 8 cm. long; kernels red, short to midlong, soft, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush midsized to large, midlong.

Saline has good resistance to mosaic and some resistance to leaf and stem rust, but is susceptible to loose smut. Its grain is of good soft-wheat quality.

History.—Saline (C. I. 12674) was developed in cooperative experiments at the Illinois Agricultural Experiment Station at Urbana from a cross between Wabash and Illinois No. 2. Selection 40–679, which was later named Saline, was made in 1940 and distributed in the fall of 1950.

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BLACKHAWK

Description.—Plant winter habit, midseason to late, tall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, wanting; beaks narrow, acuminate, 1 to 3 mm. long; awns 5 to 8 cm. long; kernels red, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush small, midlong.

Blackhawk is resistant to leaf rust, bunt, and flag smut, and moderately resistant to stem rust and loose smut. It is winter-hardy and of satisfactory soft wheat quality. It is susceptible to mosaic.

History.—Blackhawk (C. I. 12218) (reg. 341) was developed at the Wisconsin Agricultural Experiment Station in experiments cooperative with the Division of Cereal Crops and Diseases from a cross between a sister selection of Wabash (Br-M1–4) and Minturki made in 1930. It was carried as H59–13–9–5–7–12 after its selection in the seventh generation. It was distributed to farmers in Wisconsin in the fall of 1944 and is recommended for growing in that State.

Distribution.—Estimated area in 1949, 71,506 acres, grown in 11 States, the largest acreage being in Wisconsin.

GIPSY

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to square; beaks 2 to 8 mm. long; awns 3 to 7 cm. long; kernels red, midlong, soft, ovate, humped; germ midsized; crease midwide, shallow to middeep, pitted; cheeks usually rounded; brush small, midlong.

History.—The origin of Gipsy (C. I. 3436) (reg. 127) is undetermined. It was grown in Missouri as early as 1877 (*1*) and at the Ohio Agricultural Experiment Station by 1888 (*69, p. 28*). There is a tradition that the name was given the variety because it was first obtained from a gypsy.

Distribution.—Estimated area in 1949, 1,255 acres, grown in Ohio.

Synonyms.—Lebanon, Niagara, Reliable.

ROYAL

Description.—Plant winter habit, midseason, midtall to tall; stem white, midstrong; spike awned, fusiform to oblong, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders nar-

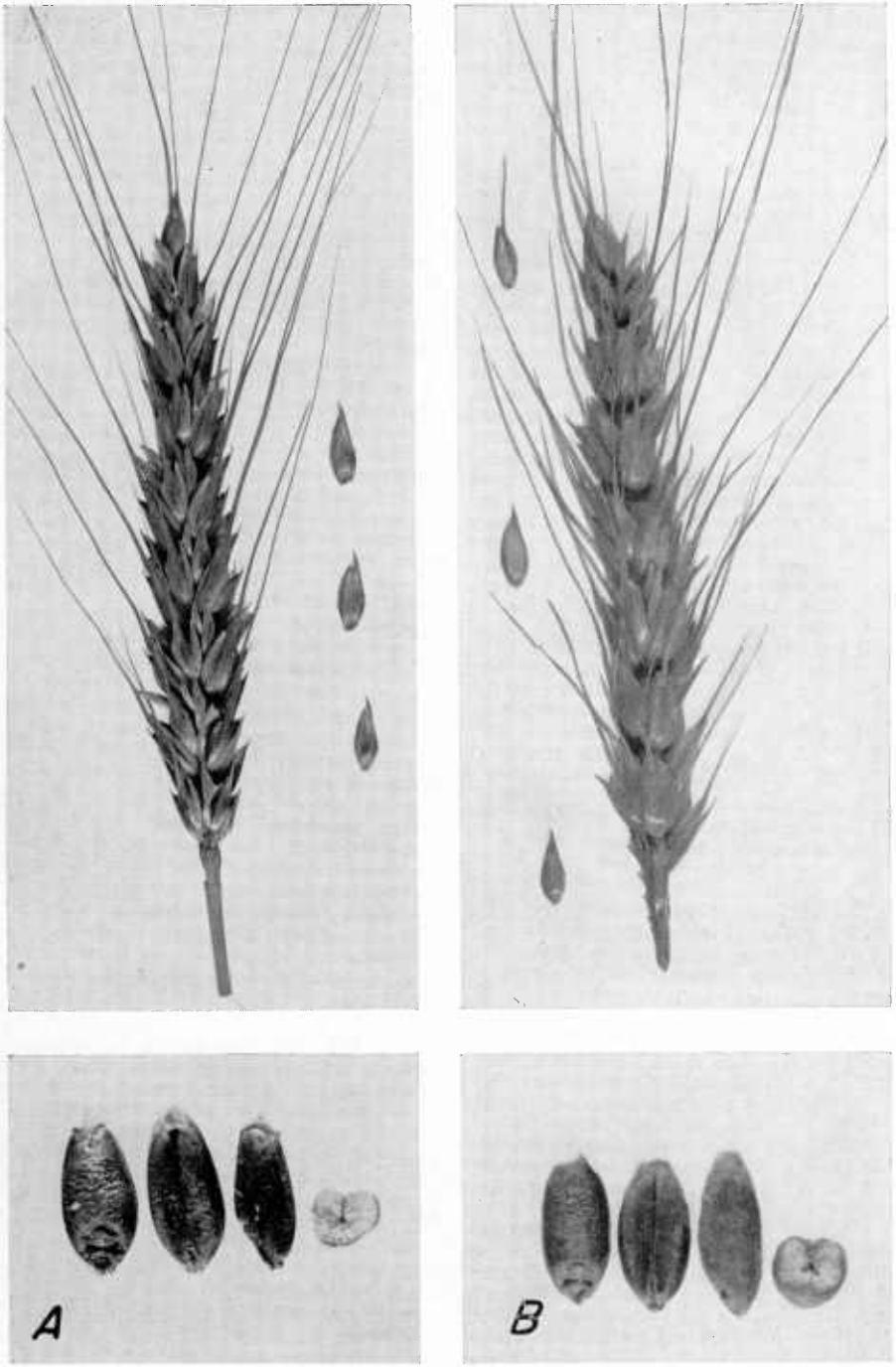

FIGURE 68.—*A*, Kawvale and *B*, Fulcaster wheats: Spikes and glumes, × 1; kernels, × 3.

row, wanting to rounded; beaks narrow, acuminate, 5 to 8 mm. long; kernels red, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Royal is resistant to flag smut and is moderately resistant to stem rust and to mosaic. It has satisfactory soft-wheat quality.

History.—Royal (C. I. 12558) was developed by the Illinois Agricultural Experiment Station from resistant plants selected from Illinois No. 2 grown on a field infested with mosaic near Delavan, Ill., in 1935. It was designated as D85 during the testing period and was distributed in 1947.

Distribution.—Estimated area in 1949, 85,384 acres, grown in Illinois, Indiana, and Ohio.

NEWCASTER

Description.—Plant winter habit, midseason, midtall to tall; stem white, weak; spike awned, fusiform, lax, inclined; glumes glabrous, white, midlong, midwide; shoulders narrow, wanting to oblique; beaks narrow, acuminate, 5 to 7 mm. long; awns 5 to 8 cm. long; kernels red, midlong, soft, ovate; germ small; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Newcaster has a trace of purple in its stems, but is otherwise similar to Fulcaster in plant and quality characters. It is highly resistant to mosaic and to flag smut.

History.—Newcaster (C. I. 12528) was developed as a selection from Fulcaster by the Illinois Agricultural Experiment Station. Seed of Fulcaster from several farmers in southern Illinois was grown on the Agronomy Farm at Urbana and heads were selected for further testing. One of these selections resulted in Newcaster. It was distributed in Illinois in 1946.

Distribution.—Estimated area in 1949, 42,814 acres, grown in Illinois.

VALLEY

Description.—Valley differs from Gipsy only in being taller and slightly earlier and in having slightly longer spikes, beaks, and glumes.

History.—Valley (C. I. 5923) (reg. 128) was obtained by the Ohio Agricultural Experiment Station from Elias Tetter, Pleasant Plain, Ohio, in 1883 and grown by that station for the first time in 1884 (*69, p. 35*). It is said to have originated in the Scioto Valley, Ohio (*103, p. 3*).

Indiana Swamp is a name under which a sample of wheat very similar to Valley was obtained from the Illinois station in 1913. A wheat under that name was grown by that station as early as 1902. The Everitt O. K. Seed Store advertised Indiana Swamp wheat in 1899, stating that it was of the Mediterranean type. The name "Swamp" is also used for several other varieties.

Distribution.—Estimated area in 1949, 464 acres, grown in Ohio.

Synonyms.—German Amber, Indiana Swamp, Niagara, Russian Amber.

KAWVALE

Description.—Plant winter habit, midseason, midtall; stem purple, strong; spike awned, fusiform, middense, erect to inclined, easily shattered; glumes glabrous, white, short, midwide; shoulders narrow, wanting to oblique; beaks narrow, acute, incurving, 1 to 3 mm. long; awns 3 to 6 cm. long; kernels red, midlong, semihard to hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 68, *A*.)

This variety is more winter-hardy than most soft or semihard red winter wheats. It is resistant to loose smut and is somewhat resistant to leaf and stem rust and to hessian fly. Flour from Kawvale is more granular than from varieties of typical soft wheat and is not satisfactory for making cakes and pastries.

History.—Kawvale (C. I. 8180) (reg. 265) was developed at the Kansas Agricultural Experiment Station, Manhattan, in cooperative experiments with the Division of Cereal Crops and Diseases. The selection was made in 1918 from Indiana Swamp, a synonym of Valley. The variety was released for commercial growing in the fall of 1932.

Distribution.—Estimated area in 1949, 300,594 acres (fig. 69).

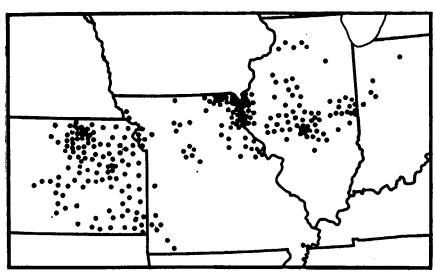

FIGURE 69.—Distribution of Kawvale wheat in 1949. Estimated area, 300,594 acres.

RED INDIAN

Description.—Red Indian is similar to Fulcaster except for having shorter, stronger, and less purple stems.

History.—The history of Red Indian (C. I. 8382) (reg. 294) is undetermined. It is a distinct strain of Fulcaster grown in Ohio. Seed was obtained in September 1927 from C. O. Pierman, Ottawa, Ohio.

Distribution.—Estimated area in 1949, 91 acres, grown in Ohio.

MAMMOTH RED

Description.—Mammoth Red is similar to Fulcaster except for being slightly later and shorter and in having a slightly larger and harder kernel.

History.—Mammoth Red (C. I. 2008) (reg. 132), distributed by the David Hardie Seed Co., Dallas, Tex., in the early nineties, was first obtained by the United States Department of Agriculture in 1904 from the 101 Ranch, Bliss, Okla. In experiments at the Maryland Agricultural College, College Park, Md., it was highest yielding of the many varieties tested over a period of years and was distributed from that station and from the Arlington Experiment Farm, Rosslyn, Va.

Distribution.—Estimated area in 1949, 8,323 acres, grown in Delaware and Maryland.

FULCASTER

Description.—Plant winter habit, midseason, tall; stem purple, midstrong to strong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide to wide; shoulders midwide, oblique to square; beaks 2 to 8 mm. long; awns 3 to 6 cm. long; kernels red, midlong, soft, ovate, humped; germ midsized; crease midwide, middeep, sometimes pitted; cheeks usually angular; brush midsized, midlong. (See fig. 68, *B.*)

Fulcaster differs from Gipsy and Valley in having purple straw. A prominent characteristic is the orange-colored stripes on the glumes. It has long been a popular and widely grown variety.

History.—According to Carleton (*35, p. 70*), Fulcaster (C. I. 4862) (reg. 131) ". . . was produced in 1886 by S. M. Schindel, of Hagerstown, Md., and is [from] a hybrid between Fultz and Lancaster . . . , the latter being the Mediterranean variety."

Many names have been used for wheat similar to Fulcaster. The earliest record is under the name "Dietz." Dietz was first included in the varietal experiments of the Ohio Agricultural Experiment Station in 1884. The same wheat, however, apparently soon came to be called Dietz Longberry (*2, p. 591*) and was later known as Dietz Longberry Red (*34, p. 18*). The true origin of Dietz Longberry and Fulcaster is somewhat obscure. The former has the earlier published history. However, according to N. Schmitz, formerly of the Maryland Agricultural Experiment Station, Mr. Schindel claimed that Mr. Dietz merely gave the name Dietz Longberry to his Fulcaster wheat.

Among the other names Stoner and Miracle are most commonly used.

Stoner cannot be distinguished from Fulcaster by any character and is here considered merely a synonym of that variety. The history of Stoner has been recorded by Ball and Leighty (*19*).

Distribution.—Estimated area in 1949, 354,137 acres (fig. 70).

Synonyms.—Bearded Bluestem, Cumberland Valley, Dietz, Dietz Longberry, Duffy, King, Lancaster, Marvelous, Miracle, Peck, Red Wonder, Stoner, Winter King.

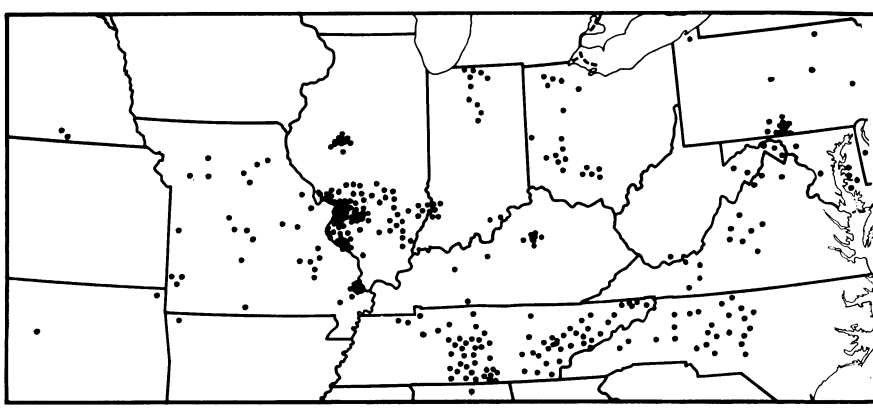

FIGURE 70.—Distribution of Fulcaster wheat in 1949. Estimated area, 354,137 acres.

NUDEL

Description.—Nudel is similar to Fulcaster, except in being more uniform and in giving higher yields than Nittany and Thorne in Delaware, especially on sandy soils. It also seems to be damaged less by scab.

History.—Nudel (C. I. 12672) resulted from a head selected by the Delaware Agricultural Experiment Station from a field of wheat thought to be Fulcaster growing on the farm of G. Y. Carrow near Dover, Del., in 1930. It was distributed in 1947.

Distribution.—Estimated area in 1949, 692 acres, grown in Delaware.

V. P. I. 131

Description.—This selection of Fulcaster differs from Fulcaster only in having somewhat shorter beaks and in being more uniform.

History.—V. P. I. 131 (C. I. 10047) (reg. 295) is the result of a plant selected in 1905 from Fulcaster by the Virginia Polytechnic Institute, Blacksburg. It was first distributed for commercial growing in 1915.

Distribution.—Estimated area in 1949, 81,402 acres, grown in Virginia, North Carolina, West Virginia, Maryland, and Arkansas.

BUTLER

Description.—Plant winter habit, midseason, midtall; stem purple; spike awned, oblong, middense, inclined; glumes glabrous, white, midlong, narrow to midwide; shoulders narrow, rounded; beaks midwide, acute, 1 to 2 mm. long; awns 5 to 7 cm. long; kernels red, midlong, soft, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Butler has straw strength nearly as good as Thorne and is more winter-hardy. It is resistant to mosaic, flag smut, several races of loose smut, and is similar to Trumbull in reaction to scab. It has good soft-wheat quality.

History.—Butler (C. I. 12527) was developed at the Ohio Agricultural Experiment Station from a cross between OSU 101–3 and Trumbull made at Columbus in 1928. OSU 101–3 is a selection from a cross between Portage and Fulcaster. The selection that resulted in Butler was made at Wooster in 1933. During the testing period it was designated as T. N. 1151. It was distributed to farmers in the fall of 1947.

Distribution.—Estimated area in 1949, 52,160 acres, grown in Ohio, Indiana, and West Virginia.

NITTANY (PENN. NO. 44)

Description.—Plant winter habit, midseason to late, tall; stem purple, midstrong to strong; spike awned, oblong to fusiform, middense, erect to inclined; glumes glabrous, white, midlong, wide; shoulders midwide, oblique to square; beaks 2 to 10 mm. long; awns 3 to 8 cm. long; kernels red, midlong, soft, ovate, humped; germ midsized; crease wide, middeep, sometimes pitted; cheeks angular; brush large, midlong.

This variety differs from Fulcaster in being later and taller, in having spikes more oblong and slightly longer beaks, and in producing higher yields in the Eastern States. The kernels are softer than Fulcaster.

History.—Nittany (C. I. 6962) (reg. 254) was developed (*161, p. 7*) by the Pennsylvania Agricultural Experiment Station, State College. It is the result of a plant selection from Fulcaster made in 1909. This variety has been grown commercially in Pennsylvania since 1918 as Penn. No. 44, or Nittany.

Distribution.—Estimated area in 1949, 110,369 acres, grown in nine Eastern States, the largest acreages being in Maryland and Pennsylvania.

Synonym.—Penn. No. 44.

PROGRESS

Description.—Plant spring habit, early, midtall; stem white, midstrong; spike awned, fusiform, middense, erect to inclined; glumes glabrous, white, long, narrow; shoulders narrow, rounding to elevated; beaks 2 to 10 mm. long; awns 2 to 8 cm. long; kernels red, midlong, soft to semihard, ovate; germ midsized; crease narrow to midwide, shallow; cheeks rounded; brush midsized, short.

Progress is resistant to powdery mildew and moderately resistant to stem rust, but its kernels are softer than those of the hard red spring varieties and, although high in protein content, the protein is of poor quality and it usually produces bread of low loaf volume and of poor grain and texture.

History.—Progress (C. I. 6902) (reg. 234) was developed at the Marshfield branch station of the Wisconsin Agricultural Experiment Station. It is the result of a plant selection from a field of Java wheat made in 1916. It was distributed for commercial growing in 1921.

Distribution.—Estimated area in 1949, 1,504 acres, grown in Wisconsin and Minnesota.

Synonyms.—Canadian Progress, Nordhougen, Prosper.

FIGURE 71.—*A*, Triumph and *B*, Wichita wheats: Spikes and glumes, × 1; kernels, × 3.

TRIUMPH

Description.—Plant winter habit, very early, short; stem white, strong; spike awned, fusiform to oblong, middense, erect; glumes glabrous, white, midlong, narrow to midwide; shoulders narrow, wanting; beaks midwide, acuminate, 2 to 5 mm. long; awns 3 to 8 cm. long; kernels red, short to midlong, hard, ovate; germ small; crease midwide, shallow; cheeks rounded; brush midsized, midlong. (See fig. 71, *A*.)

Triumph is a very early variety with moderately strong straw. Its quality is satisfactory for family flour, but it is only fair as a baker's bread flour.

History.—Triumph (C. I. 12132) was developed by Joseph Danne of El Reno, Okla., and distributed by him in 1940. Its parentage is not known (*181*).

Distribution.—Estimated area in 1949, 5,596,200 acres (fig. 72).

Synonyms.—Dane's Early Triumph, Early Dain, Early Premium, Early Triumph, Premium.

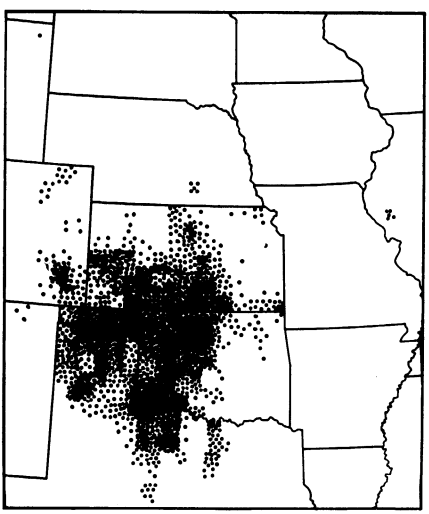

FIGURE 72.—Distribution of Triumph wheat in 1949. Estimated area, 5,596,200 acres.

WICHITA

Description.—Plant winter habit, very early, short; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white with black, midlong, narrow to midwide; shoulders narrow, wanting to oblique; beaks narrow, acuminate, 3 to 5 mm. long; awns 3 to 8 cm. long; kernels red, short to midlong, hard, ovate; germ small; crease narrow, shallow; cheeks rounded; brush midsized, midlong. (See fig. 71, *B*.)

Wichita is a very early maturing wheat, being about a week earlier than Blackhull. Its earliness often enables it to escape rust damage. It has a high test weight. Its breadbaking quality is satisfactory, being somewhat similar to that of Blackhull.

History.—Wichita (C. I. 11952) (reg. 337) was developed by the Kansas Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross between Early Blackhull and Tenmarq made in 1929. The selection that resulted in Wichita was made in 1935 and was designated as Kansas No. 2739. Seed was increased in Kansas, Oklahoma, and Texas for distribution in the fall of 1944.

Distribution.—Estimated area in 1949, 3,004,432 acres, grown in six States (fig. 73).

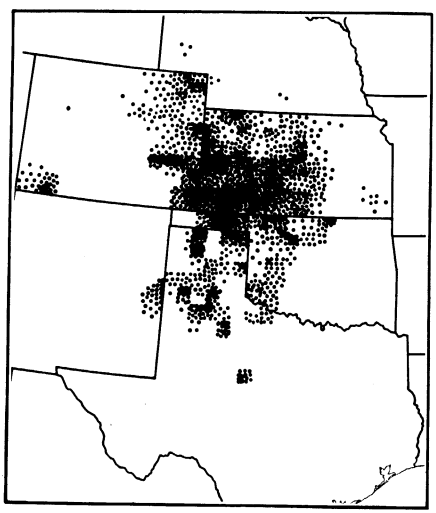

FIGURE 73.—Distribution of Wichita wheat in 1949. Estimated area, 3,004,432 acres.

EARLY BLACKHULL

Description.—Early Blackhull differs from Blackhull principally in being about 8 days earlier and somewhat shorter. In comparative experiments Early Blackhull has been less hardy and also has yielded less than Blackhull. It has fair milling and baking quality but is somewhat short in mixing time and low in water absorption.

History.—Early Blackhull (C. I. 8856) (reg. 297) was selected from a field of

Blackhull in 1921 by A. P. Haeberle, of Clearwater, Kans. Owing to various vicissitudes, seed increase was slow. In 1928 Mr. Haeberle had a 40-acre field. In December 1933 he reported that 960 bushels of seed had been sold during the previous 3 years.

Distribution.—Estimated area in 1949, 2,106,295 acres (fig. 74).

Synonyms.—Early Hardy, Early Kansas, Early Russian, Haeberle, Haeberle's Early.

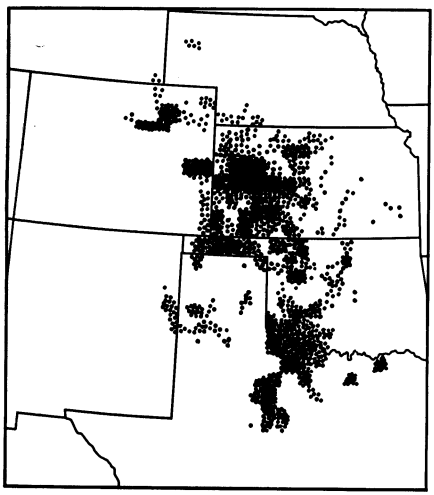

FIGURE 74.—Distribution of Early Blackhull wheat in 1949. Estimated area, 2,106,295 acres.

PAWNEE

Description.—Plant winter habit, early, short; stem white, strong; spike awned, fusiform, middense, erect; glumes glabrous, white, short, midwide; shoulders narrow to wanting; beaks narrow, acuminate, 3 to 5 mm. long; awns 3 to 8 cm. long; kernels red, short, hard, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush small, midlong. (See fig. 75, *A*.)

The superior characteristics of Pawnee are high yield, good test weight, short stiff straw, high resistance to loose smut, and moderate resistance to some races of leaf rust, stem rust, bunt, and hessian fly. It is somewhat susceptible to shattering and to *Septoria tritici*. Its quality for breadmaking is good, although it is slightly low in water absorption and mixing time. Its milling quality is good. It is about 2 days earlier than Tenmarq.

History.—Pawnee (C. I. 11669) (reg. 330) was developed in cooperative experiments of the Kansas and Nebraska Agricultural Experiment Stations and the Division of Cereal Crops and Diseases from a cross between Kawvale and Tenmarq made at Manhattan, Kans., in 1928 (*169*). In the fall of 1931, seed of F_3 plants was sent to Lincoln, Nebr. The one designated as 4444–3 was early, resistant to hessian fly, produced a high yield in a single-rod row, and was indicated as very promising at Lincoln in 1932. It continued promising and was entered in the uniform hard red winter regional yield nursery in the fall of 1934 and in field plots at Lincoln, Nebr., and Manhattan, Kans., in the fall of 1935. It was named Pawnee in 1941 and distributed in Nebraska in the fall of 1942 and in Kansas in 1943.

Distribution.—Estimated area in 1949, 11,120,653 acres (fig. 76).

PONCA

Description.—Ponca is very similar to Pawnee in observable characters. The shoulders of the glumes are somewhat wider and often square near the top of the spike, and the beaks may be slightly longer. Ponca is similar to Pawnee in time of maturity, plant height, strength of straw, test weight, and resistance to loose smut. It is superior in dough-handling properties, resistance to leaf rust, hessian fly, and to shattering, but is not so winter-hardy and is more susceptible to bunt than Pawnee. It has seedling as well as adult-plant resistance to leaf rust. It yields about the same. The grain does not bleach nor sprout in the head so readily as that of Pawnee.

History.—Ponca (C. I. 12128) was developed at the Kansas Agricultural Experiment Station at Manhattan in experiments cooperative with the Bureau of Plant Industry, Soils, and Agricultural Engineering and the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture (*129*). It was selected from the cross, Kawvale-Marquillo × Kawvale-Tenmarq, made in 1935. Its value was determined in the cooperative regional testing program, and about 3,000 bushels were distributed by the Kansas and Oklahoma stations in the fall of 1951. It is recommended for eastern Kansas and Oklahoma.

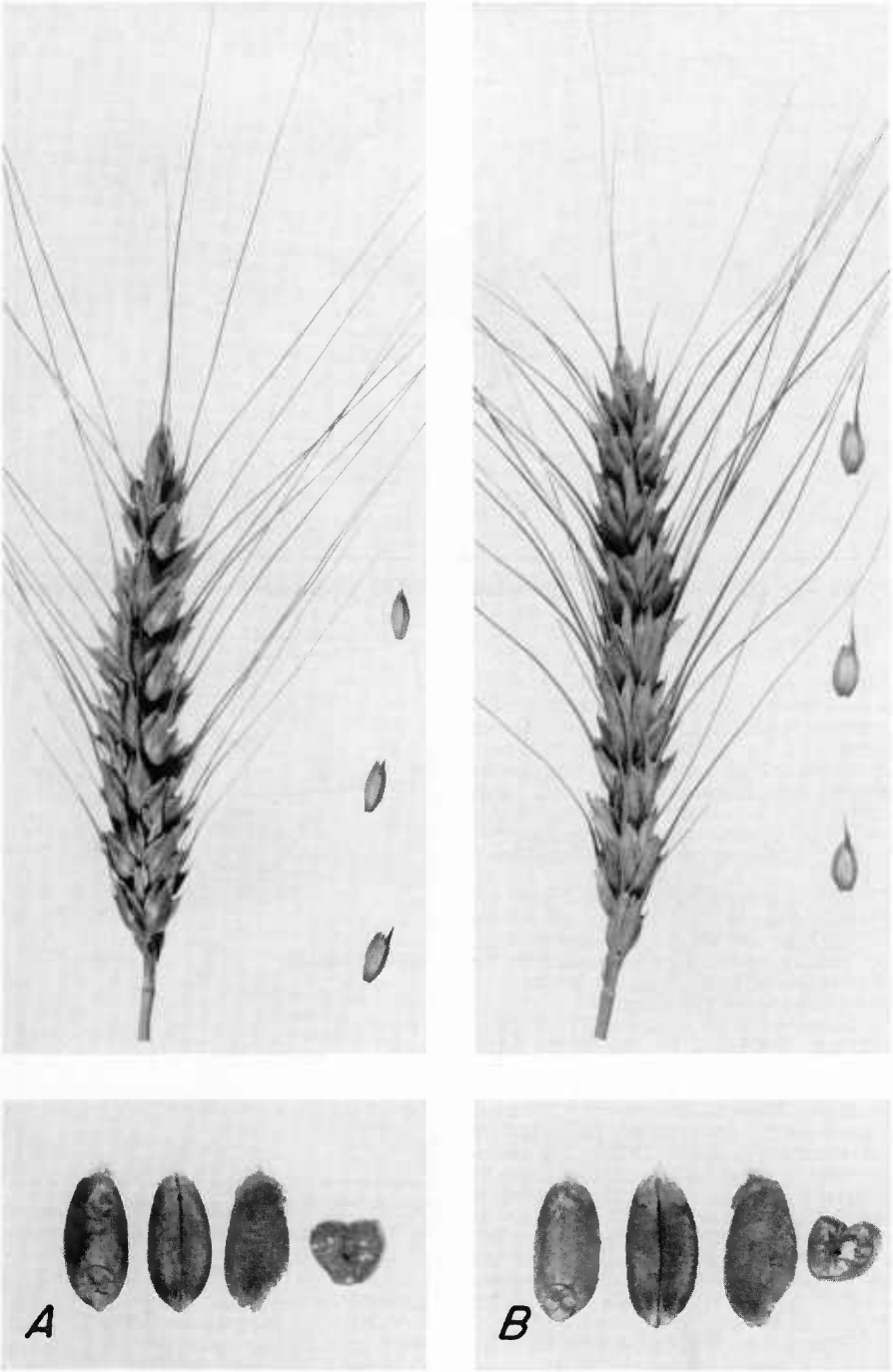

FIGURE 75.—*A*, Pawnee and *B*, Comanche wheats: Spikes and glumes, × 1; kernels, × 3.

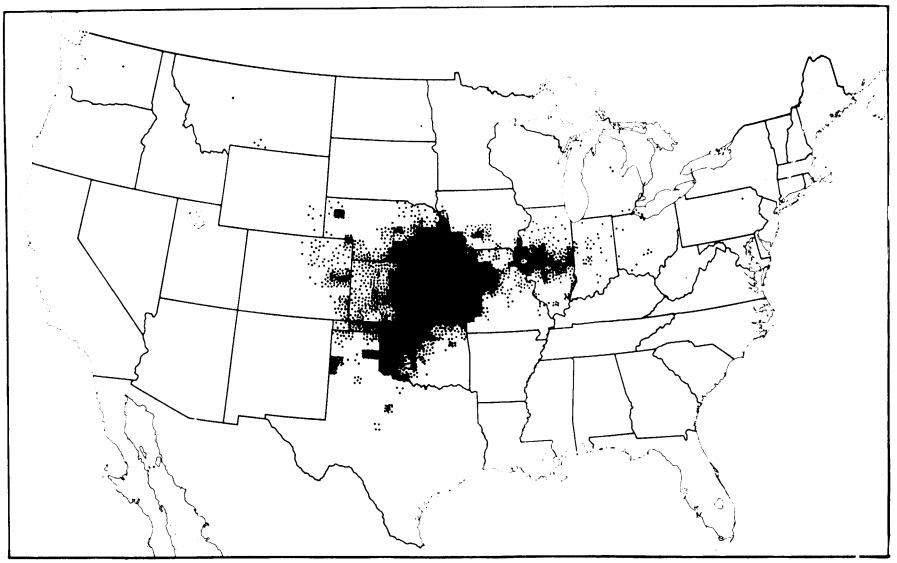

FIGURE 76.—Distribution of Pawnee wheat in 1949. Estimated area, 11,120,653 acres.

WESTAR

Description.—Plant winter habit, early to midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, wanting; beaks narrow, acuminate, 5 to 15 mm. long; awns 3 to 8 cm. long; kernels red, short, hard, ovate; germ small; crease narrow, shallow; cheeks rounded; brush midsized, midlong.

Westar has been a high-yielding wheat in tests on the high plains of Texas and has high test weight, excellent milling and baking qualities, and resistance to some races of leaf rust. It is about 3 days earlier than Tenmarq.

History.—Westar (C. I. 12110) (reg. 340) was developed by the Texas Agricultural Experiment Station at Denton in cooperation with the Division of Cereal Crops and Diseases from a cross between Kanred-Hard Federation (sel. 25007) and Tenmarq made in 1929. The selection that resulted in Westar was made in 1934, and during the testing period it was designated as No. 25–34–116. It was increased and distributed in the fall of 1944 from the Amarillo Station of the Soil Conservation Service. It is recommended for the Panhandle and plains sections of Texas.

Distribution.—Estimated area in 1949, 2,169,798 acres, grown in four States (fig. 77).

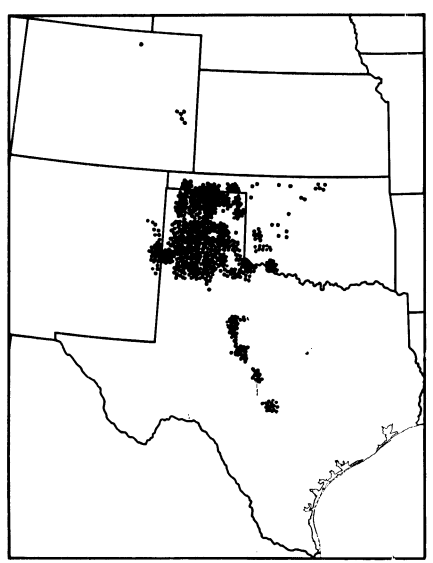

FIGURE 77.—Distribution of Westar wheat in 1949. Estimated area, 2,169,798 acres.

COMANCHE

Description.—Plant winter habit, early to midseason, short to midtall; stem white, midstrong; spike awned, oblong, middense, inclined; glumes glabrous, white, short to midlong, midwide;

shoulders narrow, wanting to elevated; beaks narrow, acuminate, 5 to 15 mm. long; awns 3 to 8 cm. long; kernels red, short to midlong, hard, ovate; germ midsized; crease midwide, middeep to deep; cheeks angular; brush midsized, midlong. (See fig. 75, *B*.)

The superior characteristics of Comanche are high yield, good test weight, earliness, stiff straw, excellent milling and baking quality, resistance to many races of bunt, and some resistance to leaf and stem rust. It is similar to Tenmarq in winter hardiness.

History.—Comanche (C. I. 11673) (reg. 331) was developed by the Kansas Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross between Oro and Tenmarq made in 1928. The selection that resulted in Comanche was made in F_5 and designated as Kansas 2729 (*169*). It was included in the Uniform Hard Red Winter Wheat Regional Nursery in the fall of 1936. It was distributed in the fall of 1942 in Kansas, Oklahoma, and Texas.

Distribution.—Estimated area in 1949, 5,931,718 acres (fig. 78).

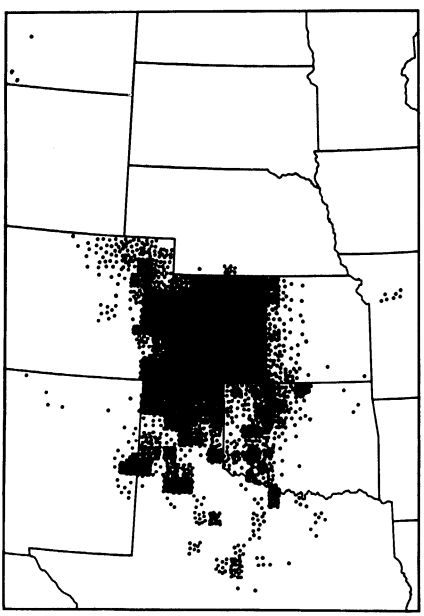

FIGURE 78.—Distribution of Comanche wheat in 1949. Estimated area, 5,931,718 acres.

QUANAH

Description.—Plant winter intermediate habit, early to midseason, midtall; stem white, midstrong; spike awned; oblong to fusiform, middense, inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, square to elevated; beaks narrow, acuminate, 5 to 15 mm. long; awns 3 to 8 cm. long; kernels red, short to midlong, hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Quanah is resistant to many races of stem rust and leaf rust and bunt or stinking smut but is susceptible to loose smut. It is similar to Comanche in general appearance but is slightly shorter and has stronger straw. Milling and baking qualities are good. Being somewhat more erect in early growth than most hard red winter varieties, Quanah is well adapted for winter grazing but is less winter-hardy than Comanche.

History.—Quanah (C. I. 12145) resulted from a compound cross (Mediterranean-Hope × Comanche) × (Comanche × Honor-Forward). It was developed by the Texas Substation No. 6 at Denton in cooperation with the Division of Cereal Crops and Diseases. The last cross was made in 1939. The selection that was named Quanah and distributed in the fall of 1950 was carried as 171–43–29 during the testing period (*10*). It was entered in the Uniform Hard Red Winter Wheat Nursery in the fall of 1946.

Distribution.—Quanah is recommended for growing in the central and rolling plains areas of Texas to replace varieties of less desirable milling and baking quality and to give protection from leaf and stem rust. About 350 bushels were distributed in the fall of 1949.

APACHE

Description.—Plant winter habit, early, midtall; stem white, slender, weak; spike awned, fusiform, middense, erect to inclined; glumes glabrous, white, midlong, narrow to midwide; shoulders narrow to midwide, rounded; beaks narrow, acuminate, 3 to 10 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate to elliptical; germ small; crease narrow, shallow; cheeks rounded; brush small, midlong.

Apache is intermediate between Early Blackhull and Comanche in maturity, has a good test weight, and good milling and breadbaking quality. It is not resistant to the rusts or smuts.

History.—Apache (C. I. 12122) was developed from a cross between Cheyenne and Early Blackhull made at Woodward, Okla., about 1932. Bulk seed in the third or fourth generation (Woodward No. 1127) was sent to the Fort Hays Experi-

ment Station, Hays, Kans., in the fall of 1935. Apache resulted from a single plant selected at Hays in 1937. By 1940 this line had demonstrated high productivity and good performance and was designated as H. C. 40–95. It was tested in the cooperative regional program, and 180 bushels were distributed by the New Mexico Agricultural Station in the fall of 1949. Apache was developed cooperatively by the Division of Cereal Crops and Diseases and the Kansas, Oklahoma, and New Mexico Agricultural Experiment Stations. It is recommended for growing in northeastern New Mexico.

KIOWA

Description.—Plant winter habit, early, midtall; stem white, strong; spike awned, fusiform to oblong, middense, inclined; glumes glabrous, white to black, midlong, midwide; shoulders wanting to narrow, oblique; beaks narrow, acuminate, 2 to 3 mm. long; awns 3 to 8 cm. long, black; kernels red, midlong, hard, ovate; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong.

The superior characteristics of Kiowa are resistance to lodging, high yield, and some resistance to shattering and to bunt. It has tolerance to stem rust but is susceptible to loose smut, leaf rust, and hessian fly. Grain of Kiowa is about 1 pound heavier in test weight than that of Comanche and does not bleach easily. Milling and baking qualities are somewhat better than those of Pawnee.

History.—Kiowa (C. I. 12133) was developed from a cross between Chiefkan and Oro-Tenmarq, the latter a sister of Comanche, at the Kansas Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases. The cross was made at Manhattan in 1938 while the selection and early testing was done at the Fort Hays Branch Experiment Station, Hays. About 1,700 bushels were distributed through the Kansas Crop Improvement Association in the fall of 1950.

MARMIN

Description.—Plant winter habit, midseason, midtall to tall; stem white, weak; spike awned, fusiform, middense to lax, inclined; glumes glabrous, yellowish white, midlong, narrow; shoulders wanting to narrow, oblique; beaks 1 to 2 mm. long; awns 3 to 8 cm. long; kernels red, midlong, semihard to hard, ovate to elliptical; germ small; crease narrow, shallow; cheeks rounded to square; brush small, midlong.

Marmin is similar to Minturki in winter hardiness and in resistance to stem rust and bunt. It has a higher test weight, slightly harder kernels, and lower carotenoid content in the grain.

History.—Marmin (C. I. 11502) (reg. 328) was developed in cooperative experiments of the Minnesota Agricultural Experiment Station and the Division of Cereal Crops and Diseases. It is the result of a cross between Minturki (winter) and Marquis (spring) made at St. Paul in 1922. During the testing period it was designated as II–22–38, Minn. No. 2614.

The variety was named, and about 1,300 bushels of seed were distributed to farmers in the fall of 1940.

Distribution.—Estimated area in 1949, 21,356 acres, grown in Minnesota, Montana, Illinois, and North Dakota.

YOGO

Description.—Plant winter habit, midseason, midtall; stem white, weak; spike awned, fusiform, middense to lax, nodding; glumes glabrous, white, midlong, narrow; shoulders wanting to narrow, rounding to oblique; beaks 1 to 2 mm. long; awns 3 to 8 cm. long; kernels red, midlong, semihard to hard, ovate to elliptical; germ small; crease narrow, middeep; cheeks rounded; brush small, midlong.

Yogo is the most winter-hardy variety grown in the United States. It is resistant to some races of bunt, and high yielding in Montana mountain valleys and in some sections of the northern Great Plains. It is easily distinguished from Turkey wheat by its lax, nodding spikes.

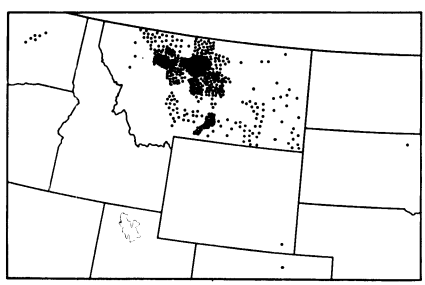

FIGURE 79.—Distribution of Yogo wheat in 1949. Estimated area, 562,186 acres.

History.—Yogo (C. I. 8033) (reg. 272) was produced from a cross (Minturki × Beloglina) × Buffum made in 1919 at the Kansas Agricultural Experiment Station, Manhattan, in a winter-hardiness breeding program, in cooperation with the Division of Cereal Crops and Diseases. Head selections from bulk progenies of the cross grown at the Judith Basin Branch Station, Moccasin, Mont., in 1923, resulted in Yogo. The variety was first grown on farms in Montana in the fall of 1932.

Distribution.—Estimated area in 1949, 562,186 acres (fig. 79).

MINTURKI

Description.—Plant winter habit, midseason, midtall; stem white, weak; spike awned, fusiform, middense, inclined; glumes glabrous, yellowish white, midlong, narrow; shoulders wanting to narrow, oblique; beaks 2 to 5 mm. long; awns 3 to 8 cm. long; kernels red, midlong, semihard, ovate to elliptical; germ small; crease narrow, shallow to middeep; cheeks rounded; brush small, midlong.

This variety is very winter-hardy and is moderately resistant to stem rust, bunt, and flag smut. It resembles Turkey but differs from Turkey principally in having softer kernels and in being more winter-hardy.

History.—Minturki (C. I. 6155) (reg. 139) is the result of a cross between Odessa and Turkey, made at the Minnesota Agricultural Experiment Station, University Farm, St. Paul, in 1902. Of the many selections made from the progeny of this cross, two have shown sufficient value to be named and distributed by the Minnesota station. This selection was first known as Minnesota No. 1507 but was named Minturki in 1919 (*97, pp. 17–28*) when it was first distributed.

Distribution.—Estimated area in 1949, 32,591 acres, grown in Minnesota, Wisconsin, Montana, and Iowa.

Synonym.—Minnesota No. 1507.

MINTER

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, wanting; beaks narrow, acuminate, 3 to 5 mm. long; awns 8 to 10 cm. long; kernels red, midlong, hard, ovate; germ small; crease narrow, middeep; cheeks rounded; brush small, midlong.

Minter is winter-hardy and is moderately resistant to stem rust and bunt. It has a higher test weight, higher water absorption, lower carotenoid content, and whiter crumb color than Minturki and Marmin.

History.—Minter (C. I. 12138) was developed by the Minnesota Agricultural Experiment Station at St. Paul in cooperation with the Division of Cereal Crops and Diseases from a cross between Minturki and Hope made in 1931 followed by one backcross to Minturki. It was designated as Minnesota No. 2713 during the testing period. The South Dakota Agricultural Experiment Station cooperated in testing some of the selections from this cross. On the basis of these tests Minter was named and distributed to growers in each of the two States in the fall of 1948.

Distribution.—Estimated area in 1949, 14,429 acres, grown in South Dakota, Minnesota, Montana, and Iowa.

RELIEF

Description.—Plant winter habit, midseason, midtall to tall; stem white, weak; spike awned, fusiform, middense to lax, inclined to nodding; glumes glabrous, white, midlong, midwide; shoulders wanting to narrow, oblique to elevated; beaks 2 to 5 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate to elliptical; germ small; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Relief differs from Turkey in being taller, in having a longer and laxer spike, darker glumes, shorter beaks, a slightly longer kernel, and in being resistant to some races of bunt including dwarf bunt.

History.—Relief (C. I. 10082) (reg. 274) was developed from a cross between Hussar and a selection from Turkey (Utah No. 26) made in 1925 at the Utah Agricultural Experiment Station, Logan. The selection that resulted in Relief was made in 1928. It was tested at several stations in the western United States in 1932 and 1933 under the designation 43c21. It showed a high degree of resistance to the races of bunt that were causing heavy losses in the Cache Valley of Utah. It also yielded well in limited trials and was distributed to a few farmers

for further trial in the fall of 1932. In 1934 the variety was named and released for general distribution (*207*).

Distribution.—Estimated area in 1949, 5,056 acres, grown in southern Idaho and Utah.

WASATCH

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, lax, inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, wanting; beaks narrow, acuminate, 3 to 5 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Wasatch is resistant to dwarf bunt and to most of the present known races of ordinary bunt. It is moderately winterhardy, has good straw, and is satisfactory in quality.

History.—Wasatch (C. I. 11925) was selected at the Utah Agricultural Experiment Station at Logan, from a cross between Relief and Ridit, both hard red winter wheats. It was carried during the testing period as Utah No. 122a327–1. It was selected for resistance to dwarf bunt and is also resistant to the races of ordinary bunt present in the West. Wasatch was distributed for growing in in the dwarf-bunt-infested areas of Utah and of western Montana in 1942. About 14,000 bushels of certified seed were distributed in Utah in 1944. When dwarf bunt became prevalent in Douglas County, Wash., seed of Wasatch was shipped in for planting in the fall of 1947.

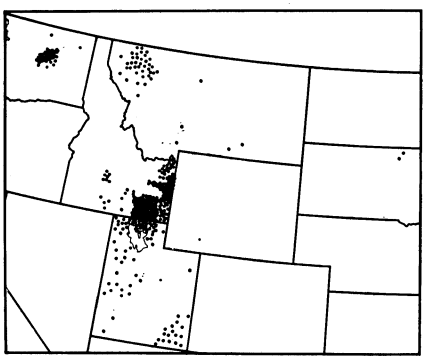

FIGURE 80.—Distribution of Wasatch wheat in 1949. Estimated area, 393,788 acres.

Distribution.—Estimated area in 1949, 393,788 acres (fig. 80).

CHEYENNE

Description.—Plant winter habit, midseason, short to midtall; stem white, slender, midstrong; spike awned, oblong to fusiform, dense, erect; glumes glabrous, white, midlong, midwide; shoulders midwide to wide, oblique to elevated; beaks 2 to 5 mm. long; kernels red, midlong, hard, ovate to elliptical; germ small; crease midwide, middeep; cheeks rounding to angular; brush midsized, midlong. (See fig. 81, *A*.)

This variety differs from Turkey principally in having shorter and stronger stems, denser, and more erect spikes, wider shoulders, and shorter beaks, and in being more susceptible to stem rust. The breadbaking characteristics also are slightly different, a longer mixing time being required for Cheyenne.

History.—Cheyenne (C. I. 8885) (reg. 269) is the result of a plant selected from Crimean (C. I. 1435) in 1922 at the Nebraska Agricultural Experiment Station, Lincoln. The new variety was included in plot tests at Lincoln in the fall of 1927 and distributed to farmers in 1930 as Nebraska No. 50. The seed originally distributed became mixed, and a purified seed supply was named Cheyenne and made available in 1933.

Distribution.—Estimated area in 1949, 1,940,510 acres, grown in eight States (fig. 82).

Synonym.—Nebraska No. 50.

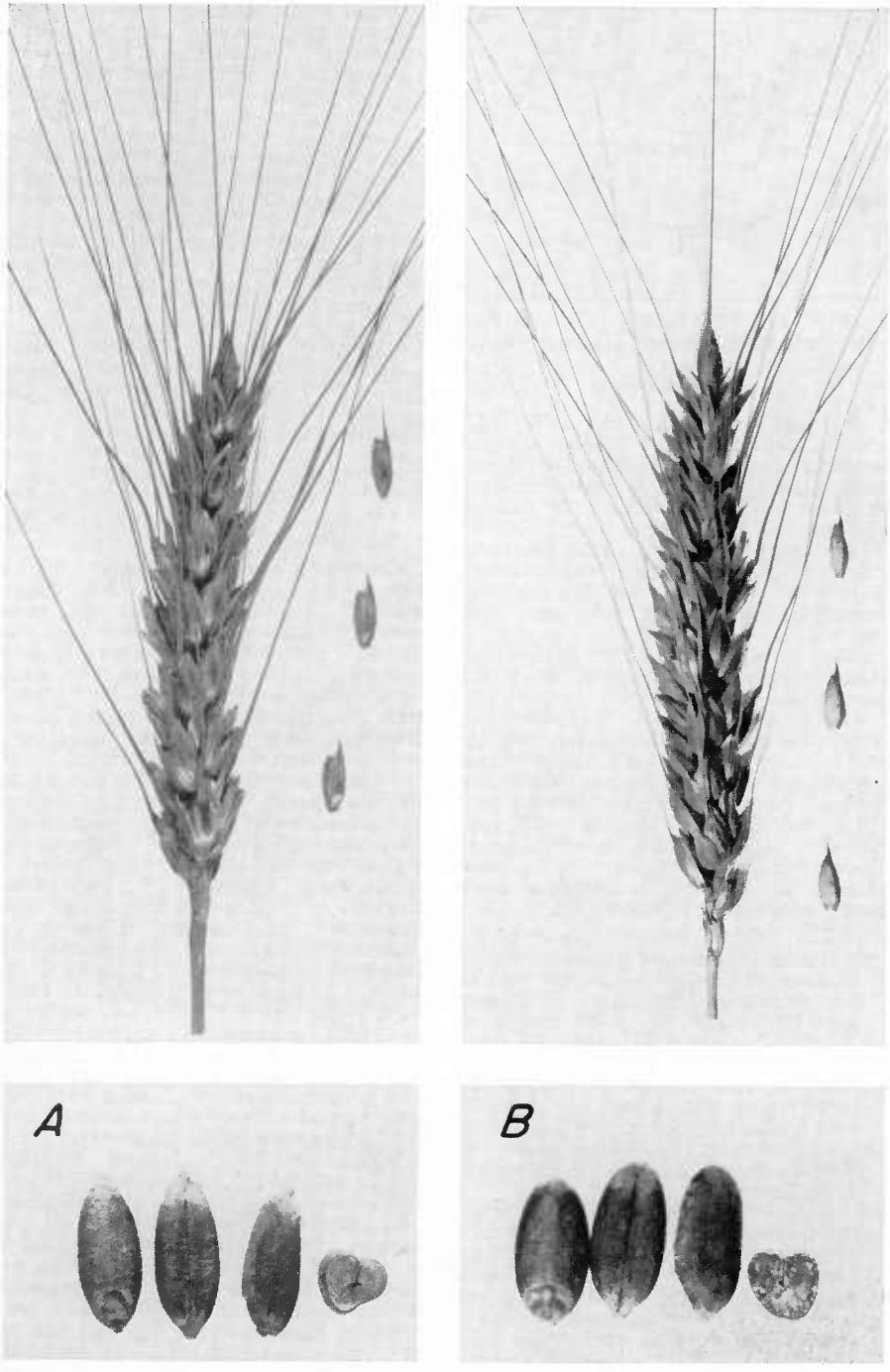

FIGURE 81.—*A*, Cheyenne and *B*, Turkey wheats: Spikes and glumes, × 1; kernels, × 3

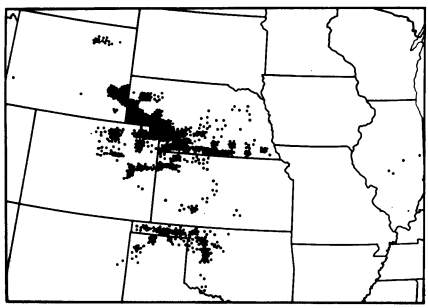

FIGURE 82.—Distribution of Cheyenne wheat in 1949. Estimated area, 1,940,510 acres.

TURKEY

Description.—Plant winter habit, midseason, midtall; stem white, slender, weak; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders wanting to narrow, oblique; beaks 2 to 8 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate to elliptical; germ small; crease narrow to midwide, middeep; cheeks rounded; brush small, midlong. (See fig. 81, *B.*)

This variety is winter-hardy and drought resistant. The first leaves are narrow and of a dark-green color.

History.—Turkey (C. I. 1558) (reg. 143) is the name most commonly used for the Crimean group of hard winter wheats grown in the United States. Many histories of this wheat have been written. That recorded by Carleton (*36, pp. 398–399*) is given here, however, as he introduced many strains and spent much time in an attempt to determine accurately the history of the wheat.

> The original home of hard winter wheat is in the area of Russia just north and east of the Black Sea and north of the Caucasus Mountains. The area includes chiefly the governments of Taurida (including the Crimea), Ekaterinoslav, Kharkof, and Stavropol, and the Don and Kuban territories. In that region the wheat is generally called simply winter wheat, but is known locally by various names as Krimka (Crimean), Kharkof, Beloglina, Ulta, Torgova, etc. * * *
>
> The history of hard winter wheat [in the United States] is closely associated with the movement of Russian Mennonite immigrants to the middle Great Plains. These people originally went from west Prussia to southern Russia about 1770 because of certain land grants and civil privileges offered by the Government under Empress Catherine. One hundred years later their descendants, desiring further advantages to be obtained in America, emigrated to the middle Great Plains and settled principally in Kansas. The greater number were from the Molochna colonies in northern Taurida, but some were from the Crimea proper and others from Ekaterinoslav. The first settlements in Kansas were made in 1873 near Newton, Halstead, and Moundridge. Each family brought over a bushel or more of Crimean wheat for seed, and from this seed was grown the first crop of Kansas hard winter wheat. Bernard Warkentin, a miller, who erected mills at Newton and Halstead, was chiefly instrumental in introducing the Turkey wheat, but in this pioneer movement of the Mennonites two other men were associated—Christian Krehbiel, first a farmer, but who later, in 1886, erected a mill at Moundridge, and C. B. Schmidt, acting as immigration agent for the Santa Fe Railroad.

Crimean is the name properly used for this whole group of hard red winter wheats. It also has been used as a varietal name for separate introductions. The first introduction of the wheat under this name is thought to have been made by Carleton in 1900 (*211*, P. I. 5635) from Kurman-Kemelchi, Central Crimea, Russia. Many other names have been used for wheat similar to Turkey.

Kharkof, for the most part, is a wheat morphologically identical with Turkey. Several introductions were made which came from a region much farther north, and it was therefore thought to be a much more winter-hardy wheat than Turkey. The Kharkof wheat was first introduced into the United States by M. A. Carleton in 1900, from Starobelsk, Kharkof, Russia (*211*, P. I. 5641, C. I. 1442). Two other strains (P. I. 7467, C. I. 1583; and P. I. 7786, C. I. 2193, or C. I. 6206) were obtained in 1901 through A. Bocnicke, president of the Kharkof Agricultural Society. The latter of these two introductions contained a considerable portion of long-beaked strains more similar to Beloglina than the true Kharkof. A fourth lot of Kharkof (P. I. 9125, C. I. 2208), consisting of 450 bushels, was received in 1902 from the Starobelsk district through E. A. Bessey. For several years these strains of Kharkof wheat gave slightly better results than the ordinary Turkey wheat of Kansas and became quite widely distributed in that State, as well as in Wyoming and Montana. In recent years, however, little difference in hardi-

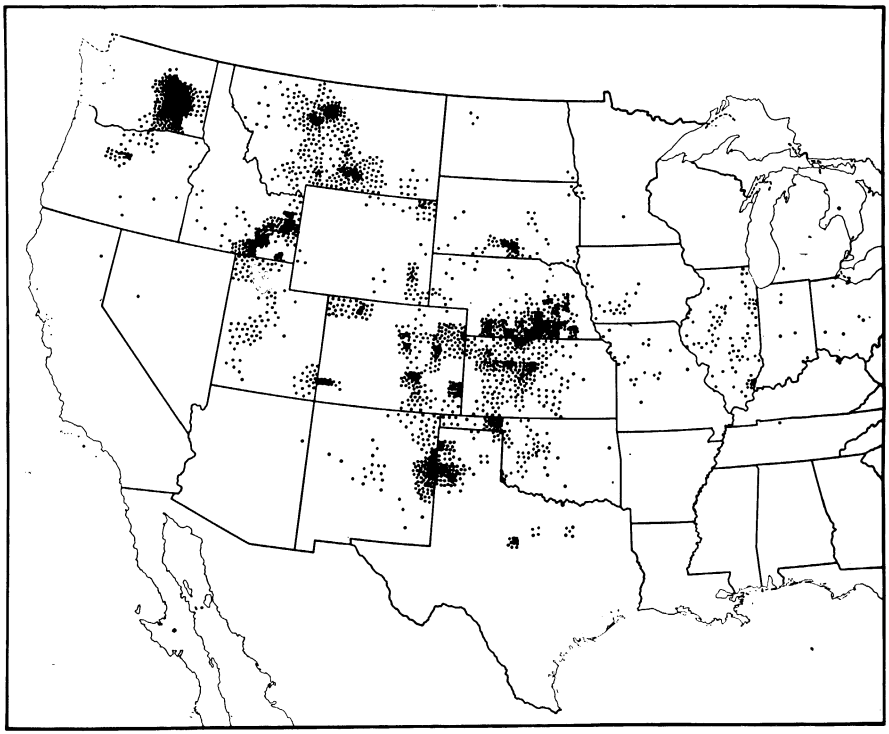

FIGURE 83.—Distribution of Turkey wheat in 1949. Estimated area, 3,311,617 acres.

ness or yield has been observed, except in northern Wyoming and in Montana, where it still consistently yields better than Turkey.

Malakof is a name under which many strains of Crimean wheat have been introduced and grown. Wheat of this name is thought to have been first distributed by the Ratekin Seed Co., Shenandoah, Iowa, in the early nineties from seed that was said to have come from Russia.

Distribution.—The acreage of Turkey wheat in 1949, including that grown under the name Kharkof and many other synonyms, is shown in figure 83. Turkey is still a widely grown variety, occupying 3,311,617 acres in 1949. In 1919 it occupied 21,598,200 acres, comprising 26.93 percent of all wheat.

Synonyms.—Alberta Red, Argentine, Bulgarian, Crimean, Hundred-and-One, Hungarian, Improved Turkey, Kharkof, Malakof, Minnesota Reliable, Pioneer Turkey, Red Russian, Romanella, Russian, Taruanian, Theiss, Turkey Red, Turkish Red, Ulta, Zuni.

KARMONT

Description.—Karmont is similar to Turkey. It is a hardy, high-yielding strain, grown largely in Montana.

History.—Karmont (C. I. 6700) (reg. 244) was developed in cooperative experiments of the Montana Agricultural Experiment Station and the Division of Cereal Crops and Diseases, at the Judith Basin Branch Station, Moccasin. It is the result of a head selection made from Kharkof (C. I. 1583) in 1911. Karmont was grown commercially in Montana for the first time in 1921.

Distribution.—Estimated area in 1949, 511,371 acres (fig. 84).

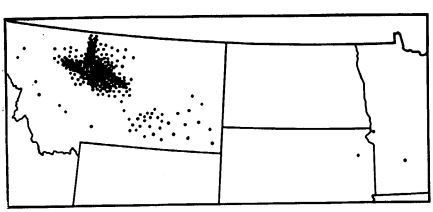

FIGURE 84.—Distribution of Karmont wheat in 1949. Estimated area, 511,371 acres.

MONTANA NO. 36

Description.—This variety cannot be distinguished from Turkey and Kharkof, but it proved superior in winter hardiness and yield in experiments in Montana.

History.—Montana No. 36 (C. I. 5549) (reg. 146) is the result of a plant selected from Kharkof at the Montana Agricultural Experiment Station, Bozeman, and distributed in the fall of 1915.

Distribution.—Estimated area in 1949, 15,952 acres, grown in Montana.

NEBRASKA NO. 60

Description.—Nebraska No. 60 is nearly identical with Turkey in all taxonomic characters but will produce heads when seeded later in the spring than Turkey.

History.—Nebraska No. 60 (C. I. 6250) (reg. 147) is a selection of Turkey wheat developed at the Nebraska Agricultural Experiment Station. It was distributed for commercial growing in the fall of 1918 because of its relatively high yields.

Distribution.—Estimated area in 1949, 39,717 acres, grown in Nebraska, Oklahoma, and Iowa.

NEBRED

Description.—Plants of Nebred differ from those of Turkey in being slightly earlier, shorter, and stronger and in having a glaucous color. Nebred is resistant to the races of bunt known to be present in Nebraska and is winter-hardy. It is susceptible to stem and leaf rust but seems to be able to produce a better crop when infected than many other varieties.

History.—Nebred (C. I. 10094) (reg. 321) was developed in cooperative experiments of the Nebraska Agricultural Experiment Station and the Division of Cereal Crops and Diseases. The original selection was made in 1924 from a plot of Turkey (S. Dak. 144, C. I. 3684) at Lincoln. Seed for the plot had been inoculated with bunt, and an epidemic of stem rust also was created in the spring. Heads were selected from plants that were free of bunt and that showed the lowest infection of rust. In succeeding years these selections were inoculated with bunt, and only the resistant ones were continued. Nebred (Nebraska No. 1063) was named in the fall of 1938 when about 1,100 bushels were distributed.

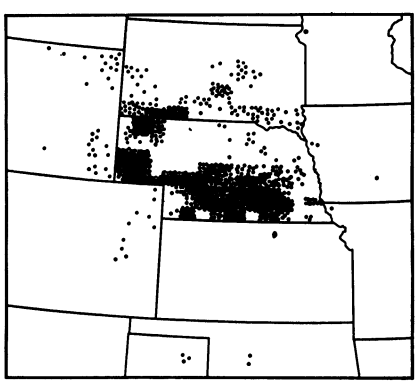

FIGURE 85.—Distribution of Nebred wheat in 1949. Estimated area, 1,457,375 acres.

Distribution.—Estimated area in 1949, 1,457,375 acres, grown in nine States (fig. 85).

SIOUX

Description.—Sioux is similar to Nebred in winter hardiness, bunt resistance, yield, and quality.

History.—Sioux (C. I. 12142) was selected at the North Platte (Nebraska) Substation in 1939 from a cross between Cheyenne and Turkey (*170*). The cross was made at Lincoln. Sioux was developed in experiments cooperative between the Nebraska Agricultural Experiment Station and the Division of Cereal Crops and Diseases. It was distributed in the fall of 1951 and recommended for growing in central and western Nebraska.

RIO

Description.—Rio differs from Turkey only in having slightly shorter stems and in being resistant to many races of bunt.

History.—Rio (C. I. 10061) (reg. 275) is the result of a head selected from Argentine (C. I. 1569), a Crimean wheat obtained from the Marseille (France) grain exchange by the United States Department of Agriculture in 1900. The selection was made in 1920 at Moro, Oreg., in cooperative investigations between the Oregon Agricultural Experiment Station and the Division of Cereal Crops and Diseases. It is resistant to many races of bunt and gives high yields of a good quality of grain. Rio was first distributed to farmers in Sherman County, Oreg., in 1931.

Distribution.—Estimated area in 1949, 114,948 acres, grown in Washington, Oregon, and California. Probably much of the acreage grown as Turkey in the Pacific Northwest is really Rio.

RELIANT

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong,

FIGURE 86.—*A*, Tenmarq and *B*, Blackhull wheats; Spikes and glumes, × 1; kernels, × 3.

narrow to midwide; shoulders narrow, wanting; beaks narrow, acuminate, 5 to 8 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush small, midlong.

Reliant has some resistance to leaf rust. Its milling and breadbaking quality is poor.

History.—Reliant (C. I. 12144) was selected from a cross Kanred × Blackhull made in 1924 by Joseph Danne of El Reno, Okla., and distributed by him in 1940.

Distribution.—Estimated area in 1949, 2,430 acres, grown in Oklahoma.

IOTURK

Description.—Ioturk is similar to Turkey, except for being slightly later and in being resistant to some races of bunt.

History.—Ioturk (C. I. 11388) (reg. 266) is a selection from Turkey made by the Farm-Crop Section of the Iowa Agricultural Experiment Station, Ames. It was distributed for commercial growing about 1926.

Distribution.—Estimated area in 1949, 4,762 acres, grown in Iowa and Nebraska.

TENMARQ

Description.—Plant winter habit, midseason, midtall; stem white, slender, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders wanting to midwide, oblique to elevated; beaks 3 to 30 mm. long; awns 3 to 8 cm. long; kernels red, short to midlong, hard, ovate; germ small to midsized; crease midwide, middeep; cheeks rounded to angular; brush midsized, midlong. (See fig. 86 *A*.)

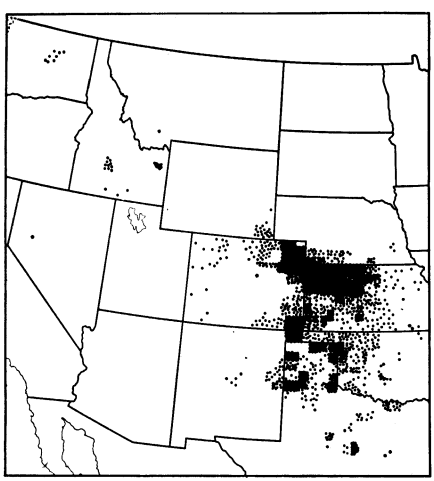

FIGURE 87.—Distribution of Tenmarq wheat in 1949. Estimated area, 2,902,645 acres.

Tenmarq differs from Kanred in being earlier and less winter-hardy and in having stronger stems and shorter kernels, as well as resistance to some races of stem and leaf rust.

History.—Tenmarq (C. I. 6936) (reg. 264) was produced from a hybrid between Marquis and P–1066, the latter a sister selection of Kanred made from Crimean (C. I. 1435). The cross was made in 1917 at Manhattan, Kans., in cooperative experiments between the Kansas Agricultural Experiment Station and the Division of Cereal Crops and Diseases. Tenmarq is the result of a plant selection made in 1921. It was released for commercial growing in 1932.

Distribution.—Estimated area in 1949, 2,902,645 acres (fig. 87).

SHERMAN

Description.—Plant winter habit, midseason, midtall; stem white, weak to midstrong; spike awned, fusiform, middense to lax, inclined, easily shattered; glumes glabrous, yellowish white, midlong, narrow; shoulders wanting to narrow, oblique to square; beaks 3 to 30 mm. long; awns 3 to 8 cm. long; kernels red, midlong, semihard, ovate to elliptical; germ small; crease narrow, shallow; cheeks rounded; brush midsized, midlong.

Sherman differs from Turkey chiefly in having stronger stems, more easily shattered glumes, longer beaks, and softer kernels, and in being resistant to some races of bunt.

History.—Sherman (C. I. 4430) (reg. 249) was developed in cooperative experiments between the Oregon Agricultural Experiment Station and the Division of Cereal Crops and Diseases at the Sherman Branch Experiment Station at Moro. It is the result of a double cross between Budapest × Turkey and Zimmerman × Turkey made about 1908. The selection resulting in Sherman was made in 1915 at Moccasin, Mont. It was distributed in southern Idaho by the Idaho Agricultural Experiment Station in 1928.

Distribution.—Estimated area in 1949, 39,490 acres, grown in southern Idaho.

KANRED

Description.—Plant winter habit, midseason, midtall; stem white, weak; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, mid-

wide; shoulders narrow, oblique to elevated; beaks 3 to 25 mm. long; awns 3 to 18 cm. long; kernels dark red, midlong, hard, ovate to elliptical; germ small; crease narrow to midwide, middeep; cheeks rounded; brush small, midlong.

Kanred is very similar to Turkey, but it is slightly more winter-hardy and slightly earlier and can be distinguished from that variety by its longer beaks on the outer glumes and its resistance to some races of both leaf and stem rust. It is equal to Turkey in milling and breadmaking value.

History.—Kanred (C. I. 5146) (reg. 149) is the product of a single head selected from Crimean (C. I. 1435), which had been introduced into the United States from Russia by the United States Department of Agriculture. The head from which it descended was one of 554 selected in 1906 by the botany department of the Kansas Agricultural Experiment Station (*175*). In 1911 the more promising strains were included in experiments by the agronomy department of the Kansas station, and several of them, including Kanred, were grown in field plots. In 1916 it was discovered to be rust-resistant. During these years of preliminary testing it was known by the number P–762. In 1917 it was named Kanred (a contraction of Kansas Red). About 4,000 acres were seeded to this variety in the fall of 1917.

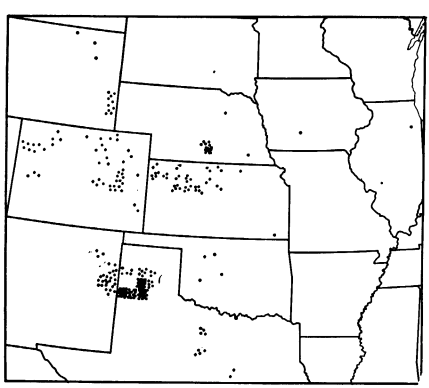

FIGURE 88.—Distribution of Kanred wheat in 1949. Estimated area, 252,049 acres.

Distribution.—The estimated area of Kanred in 1919 was 100,300 acres and in 1924, 4,314,962 acres. In 1949 the estimated area was 252,049 acres (fig. 88).

Synonym.—P–762.

UTAH KANRED

Description.—Plant winter habit, midseason, midtall; stem white, weak; spike awned, fusiform, middense to lax, nodding; glumes glabrous, yellowish with brown stripes, midlong, narrow to midwide; shoulders narrow to midwide, oblique to slightly elevated; beaks variable, 3 to 20 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate to elliptical; germ small; crease narrow to midwide, middeep; cheeks rounded; brush small, midlong.

Utah Kanred differs from Kanred in having longer, laxer, and more nodding spikes, darker glumes, and more variable and shorter beaks, and in being less winter-hardy.

History.—In experiments at the Nephi Dry-Farm Substation, Nephi, Utah, this wheat proved to be a high-yielding variety and was distributed in 1922. The original source of this variety is not known. When distributed, it was thought to be Kanred and, having been commercially grown as Kanred for many years, is now designated as Utah Kanred (C. I. 11608) (reg. 302).

Distribution.—Estimated area in 1949, 42,962 acres, grown in Utah.

Synonym.—Kanred.

WISCONSIN PEDIGREE NO. 2

Description.—Plant winter habit, midseason, midtall; stem faintly purple, slender, weak; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, narrow to midwide; shoulders wanting to narrow, oblique; beaks 2 to 8 mm. long; awns 3 to 8 cm. long; kernels red, midlong, semihard to hard, ovate to elliptical; germ small; crease narrow to midwide, middeep; cheeks rounded; brush midlong.

The variety differs from Turkey in sometimes having faintly purple stems and slightly softer kernels.

History.—Wisconsin Pedigree No. 2 (C. I. 6683) (reg. 148) is a selection of Turkey developed by the Wisconsin Agricultural Experiment Station and distributed by it in 1918.

Distribution.—Estimated area in 1949, 615 acres, grown in Illinois.

SIBLEY 81

Description.—Plant winter habit, midseason, midtall; stem purple, weak to midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, narrow to midwide; shoulders midwide, wanting to oblique to square; beaks 2 to 25 mm. long; awns 3 to 8 cm. long, sometimes purple; kernels red, midlong, semihard to hard, elliptical;

germ small to midsized; crease midwide, middeep; cheeks rounded; brush midwide, middeep. The variety shatters easily. It is resistant to some races of bunt.

History.—Several hundred heads were selected from a field of Sibley at the Oklahoma Agricultural Experiment Station in 1921. In 1927 a number of wheats including selection 81 from Sibley were tested on the farm of Earl Estil at Carrier, Okla. This selection showed up well and was distributed in 1930 as Sibley 81 (C. I. 10084).

Distribution.—Estimated area in 1949, 7,000 acres, grown in Oklahoma and Texas.

IOWIN

Description.—Plant winter habit, midseason to late, midtall to tall; stem purple and white, mostly purple, weak to midstrong; spike awned, fusiform, middense, nodding; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to elevated; beaks 5 to 25 mm. long; awns 5 to 9 cm. long; kernels red, midlong, semihard to hard, elliptical; germ small; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Iowin differs from Turkey in being taller and later, in having longer beaks, purple stems, and slightly softer kernels, and in being moderately resistant to stem rust.

History.—Iowin (C. I. 10017) (reg. 267) was developed by the Iowa Agricultural Experiment Station. It is the result of a plant selection from Theiss wheat and was first commercially grown in 1930. The advantages of Iowin are stem rust resistance and high yield under Iowa conditions.

Distribution.—Estimated area in 1949, 94,873 acres, grown in six States, the largest acreages being in Iowa and Kansas.

BLACKHULL

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, usually with black stripes, midlong, midwide; shoulders wanting to narrow, oblique; beaks 1 to 3 mm. long; awns 3 to 8 cm. long, sometimes black; kernels red, midlong, semihard to hard, usually elliptical; germ small to midsized; crease narrow, shallow; cheeks rounded; brush midsized, midlong. (See fig. 86, *B*.)

Blackhull is a few days earlier than Turkey and has a softer kernel. It is distinctly less hardy than Turkey. Except under certain unfavorable weather conditions, the glumes of Blackhull have black stripes on the surface or sometimes are almost entirely black.

History.—Blackhull (C. I. 6251) (reg. 142) was originated by Earl G. Clark (*39*), of Sedgwick, Kans., as a selection from a field of Turkey. He states:

> The Clark's Black Hull wheat is a wonderful hardy variety of wheat that I have developed from three black heads found in 1912. It has proven superior to all other varieties of winter wheat.

Blackhull was first distributed by Mr. Clark in the fall of 1917. A selected strain was distributed as Superhard Blackhull in 1925. As it usually is not possible to tell this strain from Blackhull, it is considered a synonym of that variety.

Distribution.—Estimated area in 1949, 1,786,492 acres (fig. 89).

Synonyms.—Black Chaff, Clark's Black Hull, Superhard, Superhard Blackhull.

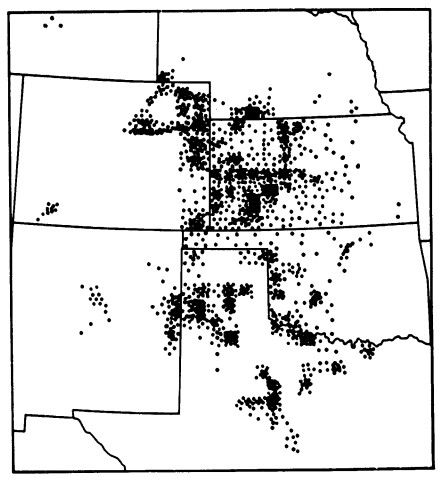

FIGURE 89.—Distribution of Blackhull wheat in 1949. Estimated area, 1,786,492 acres.

BLUE JACKET

Description.—Plant winter habit, midseason, midtall; stem white, strong; spikes awned, fusiform, middense, erect; glumes glabrous, white with black, midlong, narrow; shoulders narrow, wanting; beaks narrow, acuminate, 2 to 3 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate; germ midsized; crease midwide, shallow; cheeks rounded; brush midsized, midlong.

Blue Jacket is about a day earlier, has stiffer straw, and is slightly taller than Blackhull. It also develops a more intense black coloring in the glumes. It has a higher test weight than Blackhull.

Its baking quality is fair, being between Early Blackhull and Blackhull.

History.—Blue Jacket (C. I. 12502) was selected from a field of Superhard Blackhull by Earl G. Clark, farmer-wheat breeder, of Sedgwick, Kans. It was first distributed in 1946. Limited tests on Clark's 40–H–10, called "Improved Blue Jacket," indicate that it has somewhat better quality than the original strain.

Distribution.—Estimated area in 1949, 124,015 acres, grown in Kansas, Oklahoma, Texas, New Mexico, and Iowa.

ORIENTA

Description.—Plant winter habit, late, tall; stem white, midstrong; spike awned, fusiform, lax, inclined; glumes glabrous, white, midlong, narrow to midwide; shoulders narrow to wanting; beaks narrow, acuminate, 2 to 3 mm. long; awns 3 to 8 cm. long; kernels red, midlong, semihard to hard, ovate to elliptical, back flat to swayed; germ midsized; crease narrow, middeep; cheeks angular; brush midsized, short to midlong.

Orienta is a day or two earlier than Turkey and has some resistance to leaf rust. It has a short dough-mixing time and its bread-baking quality is poor.

History.—Orienta (C. I. 12522) was developed by the farmer-wheat breeder, Joseph Danne, of El Reno, Okla. Its parentage has not been divulged by its originator. It was designated as C 29–5–12 until 1948, when it was named Orienta and released for commercial growing.

Distribution.—Estimated area in 1949, 810 acres, grown in Oklahoma.

STAFFORD

Description.—Plant winter habit, late, tall; stem white, midstrong; spike awned, fusiform, lax, inclined; glumes glabrous, white, midlong to long, midwide; shoulders wanting to oblique; beaks midwide, acuminate, 2 to 3 mm. long; awns 3 to 8 cm. long; kernels red, midlong to long, semihard, ovate to elliptical; germ midsized to large; crease midwide, middeep; cheeks angular; brush midsized, midlong.

Stafford has some resistance to stem rust and a good test weight. Its breadbaking quality is questionable. It has a very short mixing time and is low in water absorption and in loaf volume.

History.—Stafford (C. I. 12706) resulted from a single plant selected from a field of Blackhull wheat by S. E. Blackburn, of Stafford County, Kans. The single plant appeared not to be affected by rust, while the rest of the field was heavily infested and was badly lodged. Approximately 1,000 bushels of seed were sold by Mr. Blackburn in the fall of 1949.

SPINKCOTA

Description.—Plant spring habit, midseason, tall; stem white, midstrong; spike awned, fusiform, very lax, inclined; glumes glabrous, white, long, narrow; shoulders narrow, wanting to square; beaks narrow, acute, 0.5 mm. long; awns 3 to 6 cm. long; kernels red, midlong, hard, elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush small, short.

Spinkcota has a long lax speltoid type of head, especially during the early heading stage. It is susceptible to the rusts. This variety has poor breadmaking properties.

History.—Spinkcota (C. I. 12375) was developed by T. G. Overly of Redfield, S. Dak., and distributed by him in 1944. The parentage is reported as (Preston sel. × red durum) × Preston sel.

Distribution.—Estimated area in 1949, 15,197 acres, grown in South Dakota and Minnesota.

STURGEON

Description.—Plant spring habit, early to midseason, short to midtall; stem white, midstrong; spike awned, fusiform, middense to lax, inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, rounded to elevated; beaks 1 to 3 mm. long; awns 3 to 8 cm. long; kernels red, short, semihard to hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush small to midsized, midlong.

Sturgeon is resistant to powdery mildew.

History.—Sturgeon (C. I. 11703) (reg. 278) was produced by the Wisconsin Agricultural Experiment Station (Peninsular Branch) at Sturgeon Bay, Wis. It is the result of a cross between Progress and Marquis made in 1924. The plant selection that resulted in Sturgeon was made in 1927. It was included in field plots in 1931 and was distributed for commercial growing in 1934.

Sturgeon was distributed to replace Progress, which makes flour of poor breadbaking quality. Sturgeon kernels more nearly resemble those of Marquis than those of the Progress parent. Flour from Sturgeon is superior to that from Progress, but does not equal that from Marquis in quality for bread.

Distribution.—Estimated area in 1949, 1,071 acres, grown in Minnesota and Wisconsin.

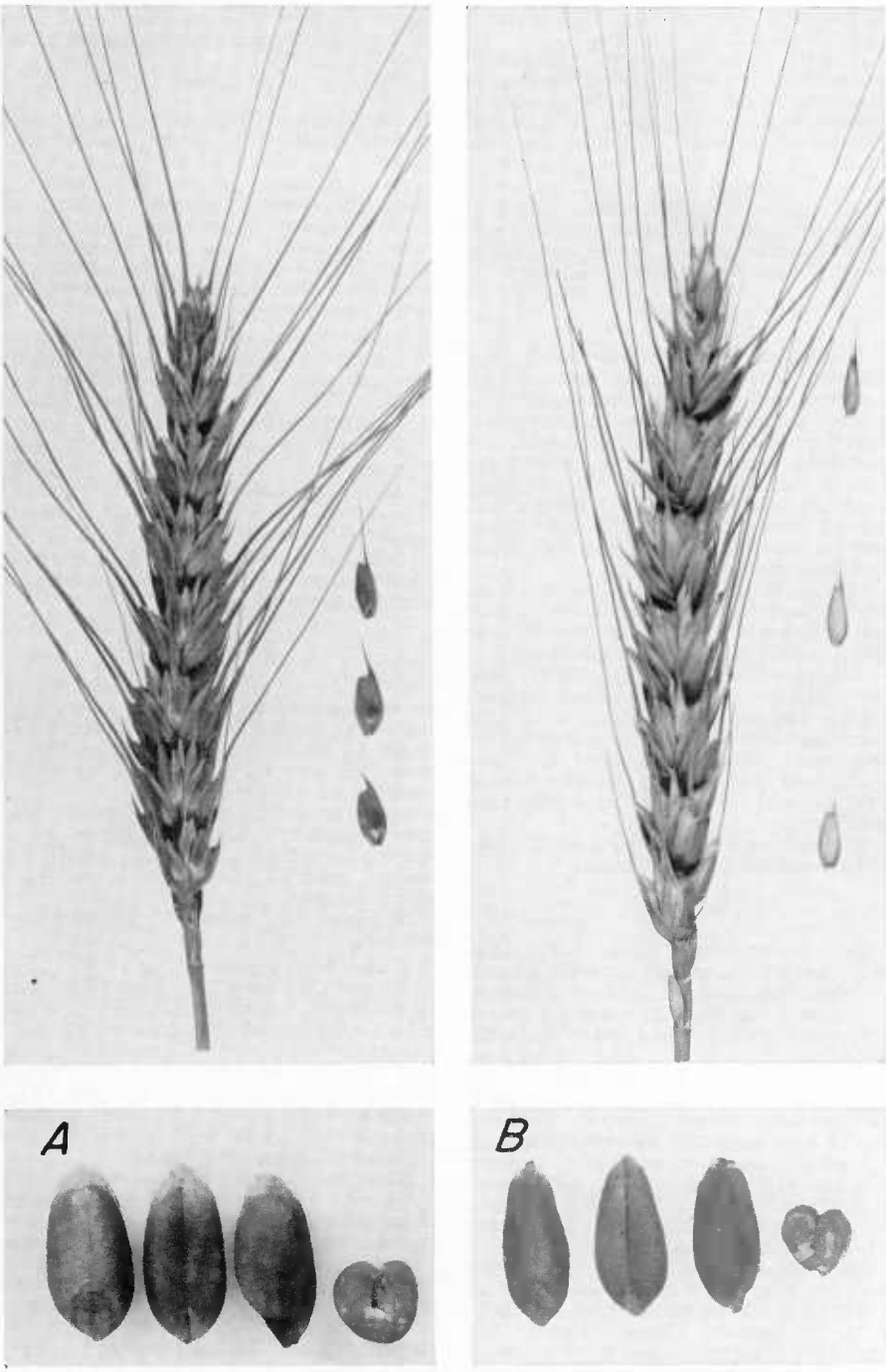

FIGURE 90.—*A*, Ceres and *B*, Henry wheats: Spikes and glumes, × 1; kernels, × 3.

KOMAR

Description.—Komar differs from Ceres in having shorter beaks (1 to 3 mm. long), weaker stems, slightly greater resistance to stem rust, and slightly harder kernels.

History.—Komar (C. I. 8004) (reg. 270) was produced (*221*) from the same cross between Marquis and Kota from which Ceres was selected. The cross was made in 1918 at the North Dakota Agricultural Experiment Station, Fargo. The selection designated as 1656.84, which resulted in Komar, was made in 1923.

Komar was distributed by the Iowa Agricultural Experiment Station in 1930 and by the Colorado Agricultural Experiment Station in 1931, but it is no longer recommended in Colorado because of its grain quality, which is objectionable to the grain trade.

Distribution.—Estimated area in 1949, 59,991 acres, grown in six States, the largest acreage being in Idaho.

Synonyms.—No. 1656, N. D. Ns. No. 1656.84.

CANUS

Description.—Plant spring habit, midseason, midtall; stem white, midstrong to strong; spike awned, fusiform, middense, erect to inclined; glumes glabrous, white, midlong, midwide; shoulders narrow, elevated; beaks midwide, acute, 5 to 10 mm. long; awns 3 to 8 cm. long; kernels red, short to midlong, hard, ovate to elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong.

Canus is resistant to foot rots and to bunt or stinking smut, but it is susceptible to rusts. It is among the spring wheat varieties more resistant to low temperatures in the seedling stage. It has satisfactory milling and breadmaking properties.

History.—Canus (C. I. 11637) (C. A. N. 1260) was developed from a cross between Marquis and Kanred made in 1918. Selections made at the University of Minnesota were taken to Canada and a further selection that resulted in Canus was made at the University of Alberta, Edmonton, in 1929 (*150*). It was named and distributed in that province in 1934. It was brought from Alberta into Montana about 1940.

Distribution.—Estimated area in 1949, 13,104 acres in Montana.

CERES

Description.—Plant spring habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, erect to inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, rounded to elevated; beaks 2 to 10 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate; germ small; crease midwide, shallow to middeep; cheeks usually angular; brush midsized, short. (See fig. 90, *A*.)

Ceres is moderately resistant to some races of stem rust and to drought.

History.—Ceres (C. I. 6900) (reg. 241) was developed (*221*) at the North Dakota Agricultural Experiment Station from a cross between Marquis and Kota made in 1918. It was distributed in North Dakota in 1926 and was widely grown because of its resistance to stem rust and drought, early maturity, high yield, and good quality. It is, however, susceptible to bunt and loose smut.

When races of stem rust to which Ceres was susceptible became prevalent, beginning about 1935, the acreage of Ceres was rapidly replaced by Thatcher.

Distribution.—Estimated area in 1949, 1,184,625 acres (fig. 91).

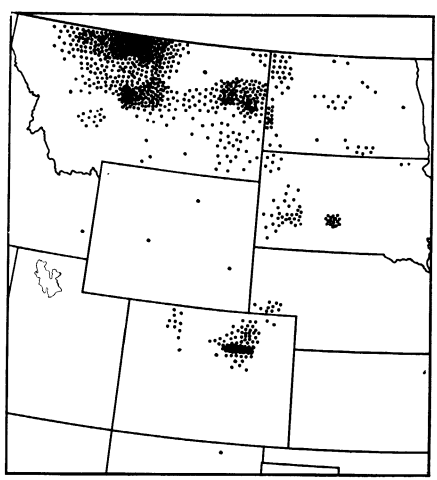

FIGURE 91.—Distribution of Ceres wheat in 1949. Estimated area, 1,184,625 acres.

VESTA

Description.—Plant spring habit, midseason, tall; stem white, weak; spike awned, fusiform, lax, inclined; glumes glabrous, white, midlong to long, narrow to midwide; shoulders wanting; beaks narrow, acuminate, 5 to 20 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate; germ small; crease narrow, shallow; cheeks rounded; brush small, midlong.

Vesta is resistant to stem rust (except race 15B) but is susceptible to leaf rust.

It is resistant to shattering but has weak straw. Its breadbaking quality is acceptable but is not equal to that of the better hard red spring varieties.

History.—Vesta (C. I. 11712) was developed by the North Dakota Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross between Ceres and a selection from a Hope-Florence cross made in 1929 (*222*). It was designated as Ns. 2592 during the testing period and was first included in the Uniform Regional Hard Red Spring Wheat Nursery in 1935. It was distributed in North Dakota in 1942.

Distribution.—Estimated area in 1949, 106,062 acres, grown in North Dakota, Montana, South Dakota, and Minnesota.

HENRY

Description.—Plant spring habit, midseason, midtall; stem purple, midstrong; spike awned, fusiform, lax, inclined; glumes glabrous, white, midlong, narrow; shoulders narrow, wanting to oblique; beaks narrow, acuminate, 1 to 5 mm. long; awns 5 to 8 cm. long; kernels red, midlong to long, semihard to hard, ovate; germ small to midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 90, *B.*)

Henry is resistant to stem rust (except race 15B), bunt, and is moderately resistant to leaf rust but is moderately susceptible to loose smut. It is about 3 days later than Thatcher and is a high-yielding variety. The variety sometimes shows the false black chaff or brown necrosis often encountered in Hope derivatives. Because of its soft-wheat characteristics, it must be specially handled to obtain satisfactory milling and baking results. When specially handled it produces bread of good loaf volume and texture.

History.—Henry (C. I. 12265) was developed by the Wisconsin Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross made in 1933 between a selection from Illinois 1 × Hope and a selection from Webster × Resaca. It was designated as H157a–4–12–8 during the testing period and was released to farmers in Wisconsin in 1944.

Distribution.—Estimated area in 1949, 168,679 acres, grown in 12 States, the largest acreages being in Wisconsin, Minnesota, and North Dakota.

HOPE

Description.—Plant spring habit, midseason, midtall; leaves pubescent; stem purple, midstrong; spike awned, fusiform, middense, erect to inclined, very resistant to shattering; glumes glabrous, white, midlong, midwide to wide; shoulders midwide, rounded to elevated; beaks 2 to 10 mm. long; awns 2 to 6 cm. long; kernels red, midlong, hard, ovate; germ small; crease wide, middeep; cheeks angular; brush large, long.

Under field conditions in the United States Hope is nearly immune from stem rust (except race 15B), flag smut, and loose smut, and is resistant to some races of leaf rust and powdery mildew. From spring seeding it also is very resistant to bunt. It is susceptible to frost and heat injury and to the black chaff disease.

History.—Hope (C. I. 8178) (reg. 240) was developed by E. S. McFadden (*138*) from a cross made in 1916 between Yaroslav emmer and Marquis wheat. The cross was made at Brookings, S. Dak., while Mr. McFadden was employed by the South Dakota Agricultural Experiment Station. Because of the wide cross, much sterility and shriveled grain were encountered in the early generations. Mechanical separation was employed, and only the plumpest grain saved. For several years the hybrid material was carried in bulk at the Highmore Substation, Highmore, S. Dak., where Mr. McFadden was conducting experiments in cooperation with the Division of Cereal Crops and Diseases. However, the selection that resulted in Hope was made in 1923 by Mr. McFadden on his farm near Webster, S. Dak., where it was increased and distributed in 1927. Hope was the first variety of hard red spring wheat to have the stem-rust reaction of emmer and has been used widely as a parent in breeding to transfer this reaction to other varieties of hard red spring wheat.

Distribution.—Not reported grown in 1949.

PILOT

Description.—Plant spring habit, midseason, midtall; leaves pubescent; stem purple, weak; spike awned, fusiform, middense to lax, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, rounded to elevated; beaks 2 to 8 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate; germ small; crease midwide, middeep; cheeks angular; brush midsized, midlong. (See fig. 92, *A.*)

Pilot is resistant to stem rust (except race 15B) and to some races of leaf rust, bunt, and powdery mildew. It has good milling and breadmaking quality.

History.—Pilot (C. I. 11428) (reg. 322) was developed by the Division of Cereal Crops and Diseases and the North Dakota and other State agricultural experiment stations cooperating in the

FIGURE 92.—*A*, Pilot and *B*, Rival wheats: Spikes and glumes, × 1; kernels, × 3.

Regional Hard Red Spring-Wheat Improvement Program. It is the result of a cross between Hope and Ceres made at Mandan, N. Dak., in 1926. The selection (N. No. 1098) was made in F_3 in 1928. Reselections were made in 1933 at Langdon, N. Dak. Eighty of the 100 head selections grown in 1934 were composited for increase as N. No. 1098A. Nine of the stem-rust-resistant, high-yielding selections grown during the rust epidemics of 1935 were composited for increase as N. No. 1098B.

Approximately 1,500 bushels of seed of a bulk of N. No. 1098 and N. No. 1098A and 80 bushels of N. No. 1098B were distributed in North Dakota for seeding in 1939. Selection N. No. 1098–13 (C. I. 11945), pure for resistance to leaf rust and mildew, was distributed about 1941 to replace the original variety.

Distribution.—Estimated area in 1949, 570,675 acres (fig. 93).

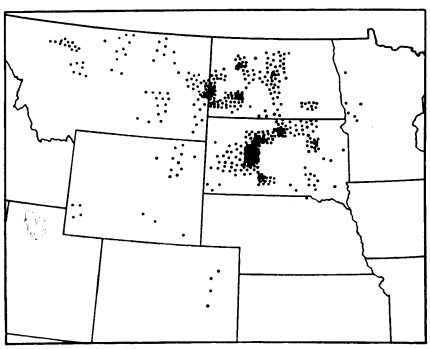

FIGURE 93.—Distribution of Pilot wheat in 1949. Estimated area, 570,675 acres.

RIVAL

Description.—Plant spring habit, midseason, midtall; stem purple, midstrong; leaves pubescent; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, rounded to elevated; beaks 5 to 20 mm. long; awns 3 to 8 cm. long; kernels red, midlong, hard, ovate; germ midsized; crease midwide, middeep; cheeks angular; brush midsized to large, midlong. (See fig. 92, *B*.)

Rival is resistant to stem rust (except race 15B) and to several races of leaf rust and to several races of bunt. It has good quality but is somewhat susceptible to shattering and to sprouting during a wet harvest.

History.—Rival (C. I. 11708) (reg. 329) is a selection from a cross made in 1929 between Ceres and a Hope × Florence hybrid. It was developed in cooperative experiments of the North Dakota Agricultural Experiment Station and the Division of Cereal Crops and Diseases. Strain 9.54.2.13, given as Ns. No. 2634, was one of the best of many selections tested from this cross and named Rival. About 725 bushels were distributed in the spring of 1939.

Distribution.—Estimated area in 1949, 2,930,903 acres (fig. 94).

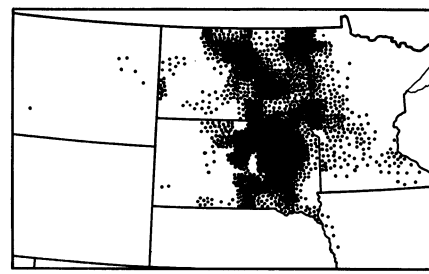

FIGURE 94.—Distribution of Rival wheat in 1949. Estimated area, 2,930,903 acres.

Mida

Description.—Plant spring habit, midseason, midtall; stem purple, midstrong to strong; spike awned, fusiform, lax to middense, inclined; glumes glabrous, white, midlong, midwide; shoulders narrow, elevated; beaks narrow, acuminate, 5 to 15 mm. long; awns 5 to 8 cm. long; kernels red, midlong to long, hard, ovate; germ midsized to large; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 95, *A*.)

Mida sometimes has blackish awns, strong straw, large kernels, and high test weight. It is resistant to stem rust (except race 15B), to some races of leaf rust, and to bunt. It is susceptible to loose smut and shattering. Its quality for breadbaking is good.

History.—Mida (C. I. 12008) (reg. 338) was developed by the North Dakota Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross between Mercury and Ceres-Double Cross (R. L. 625) (*223*). Mercury was developed at the North Dakota Agricultural Experiment Station from a cross between Ceres and a selection from Hope-Florence. Double Cross was a selection from the Marquis-Iumillo × Marquis-Kanred hybrid from which Thatcher was selected. The cross that resulted in Mida was made in the greenhouse at Fargo in December 1933. An F_5 selection Ns. No. 2829 made in 1936 was named Mida in 1944 and 15,000 bushels distributed to farmers in North Dakota in that year.

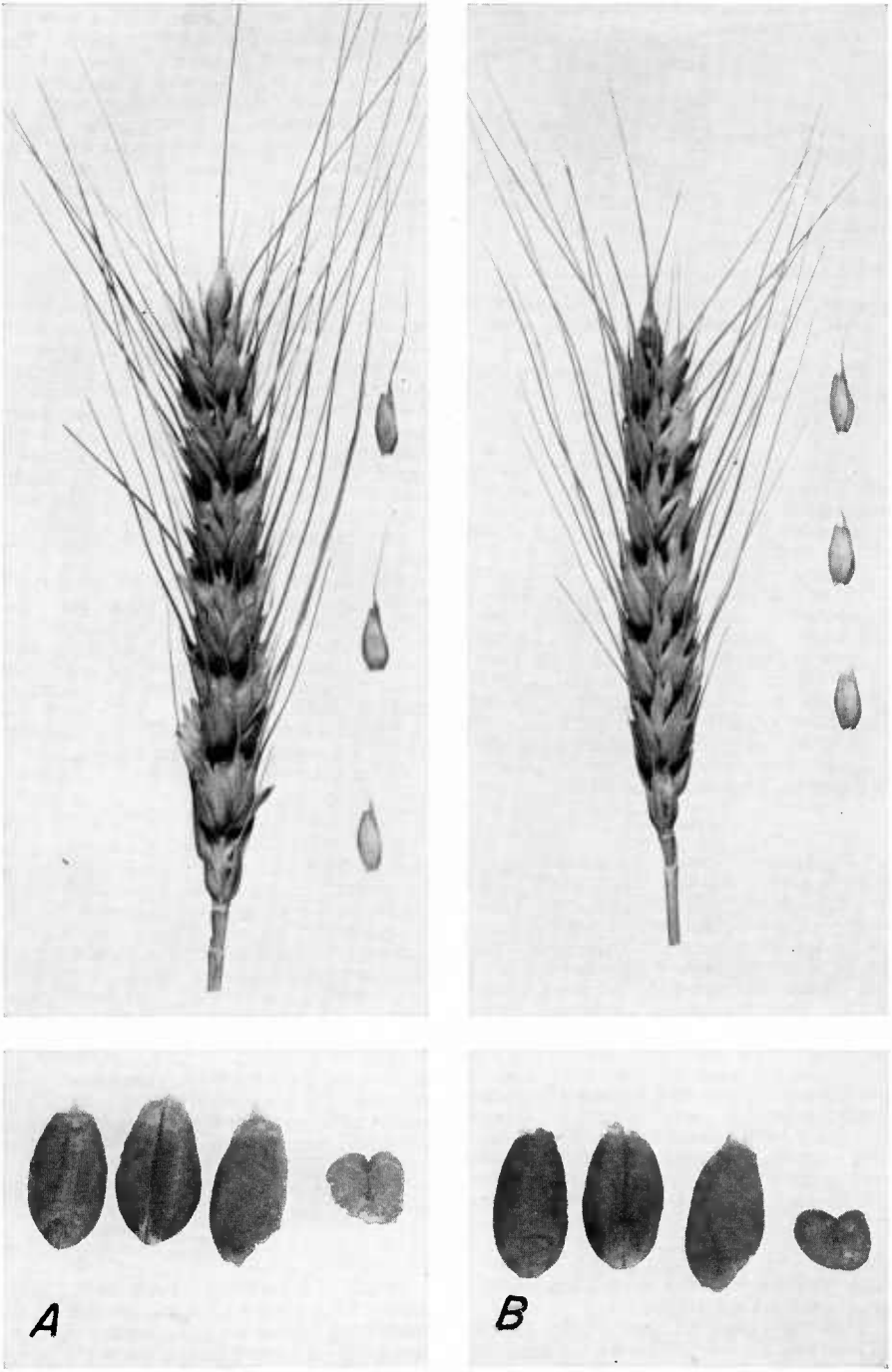

FIGURE 95.—*A*, Mida and *B*, Lee wheats: Spikes and glumes, × 1; kernels, × 3.

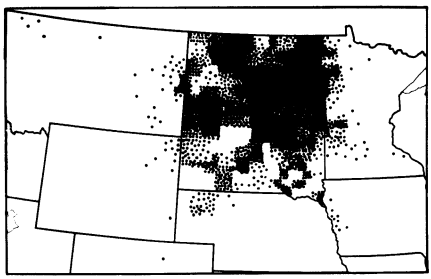

FIGURE 96.—Distribution of Mida wheat in 1949. Estimated area, 5,554,156 acres.

Distribution.—Estimated area in 1949, 5,554,156 acres (fig. 96).

PREMIER

Description.—Premier is very similar to Mida except in being resistant to loose smut and in being somewhat less susceptible to shattering and less desirable in breadbaking quality.

History.—Premier (C. I. 11940) (Ns. 2772) was developed at the North Dakota Agricultural Experiment Station from the same cross as Mida. A 2-pound sample of Ns. 2772 was sent from Fargo to El Centro, Calif., in the fall of 1937, and the seed was returned to North Dakota to plant 7 acres in 1938.

Distribution.—Estimated area in 1949, 165,614 acres, grown in North Dakota, Minnesota, Montana, and Idaho.

LEE

Description.—Plant spring habit, early, short; stem white, midstrong; spike awned, oblong to fusiform, middense, erect; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique; beaks 5 to 15 mm. long; awns 2 to 6 cm. long; kernels red, midlong, hard, ovate; germ midsized to large; crease midwide, middeep; cheeks angular; brush midsized, midlong. (See fig. 95, *B*.)

Lee is resistant to leaf rust and to the races of stem rust present in North America except race 15B. It is susceptible to loose smut, bunt, scab, mildew, and bacterial black chaff. It is the first commercial variety resistant under field conditions to the races of leaf rust now prevalent in the spring-wheat region. The grain of Lee is slightly higher in test weight than Thatcher. It has a high protein content and good milling and breadbaking properties.

History.—Lee (C. I. 12488) (Minn. 2776) was developed at the Minnesota Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross between Hope and Timstein made in 1939. The Timstein parent is a leaf- and stem-rust-resistant selection from a cross between *T. timopheevi* and Steinwedel made by J. T. Pridham of New South Wales, Australia, and was brought to this country by S. L. Macindoe, his associate.

Lee was named in 1950 and distributed in the spring of 1951. It was licensed in Canada in 1950.

NIGGER

Description.—Plant winter habit, midseason, midtall to tall; stem purple, midstrong to strong; spike awned, fusiform, middense, inclined; glumes glabrous, white, long, wide; shoulders midwide, oblique to square; beaks 1 to 2 mm. long; awns 3 to 9 cm. long; kernels red, long, soft, ovate to elliptical, slightly humped; germ midsized; crease midwide, deep, pitted; cheeks rounded to angular; brush midsized, midlong.

Nigger differs from Rudy chiefly in having shorter beaks.

History.—Nigger (C. I. 5366) (reg. 157) wheat is "said to have been first distributed from the farm of a colored man in Darke County, Ohio" (*103*, *p. 4*). It was grown in experiments by the Ohio Agricultural Experiment Station as early as 1884.

Distribution.—Estimated area in 1949, 116,191 acres, grown in six States.

Synonym.—Winter King.

NABOB

Description.—Plant winter habit, midseason, midtall; stem purple, midstrong to strong; spike awned, fusiform, middense, inclined; glumes glabrous, white, long, midwide; shoulders wanting to narrow, rounded to square; beaks 1 to 3 mm. long; awns 3 to 8 cm. long; kernels red, midlong to long, soft, elliptical; germ midsized; crease midwide, deep; cheeks angular; brush midsized, long.

History.—Nabob (C. I. 8869) (reg. 262) was developed at the Ohio Agricultural Experiment Station. It is the result of a selection from Nigger made in 1918. It was distributed for commercial growing in 1928.

Distribution.—Estimated area in 1949, 681 acres, grown in Ohio.

RUDY

Description.—Plant winter habit, midseason to late, midtall to tall; stem purple, midstrong; spike awned, linear-fusiform, lax, inclined to nodding; glumes glabrous, yellowish white with black-striped margins, midlong, wide; shoulders midwide,

usually oblique; beaks 1 to 5 mm. long; awns 3 to 8 cm. long; kernels red, long, soft, usually elliptical; germ small; crease wide, middeep; cheeks rounded; brush midsized, midlong.

Rudy is distinct in having long, soft kernels and black stripes on the glumes.

History.—The origin of Rudy (C. I. 4873) (reg. 155) has been recorded by Carleton (*35, p. 65*) as follows:

> One of the best of the more recently produced varieties is the Rudy, which was originated at Troy, Ohio, in 1871, by M. Rudy, through a careful propagation of the seed from a superior and distinct stool of wheat found in a large field.

Rudy wheat was not included in the varietal experiments of the Ohio Agricultural Experiment Station until 1892.

Distribution.—Estimated area in 1949, 163,777 acres, grown in Indiana, Illinois, and Ohio.

Synonym.—Black Mediterranean.

REQUA

Description.—Plant winter habit, midseason, midtall; stems purple and white, very weak; spike awned, oblong-fusiform, lax, nodding; glumes glabrous, brown, long, narrow to midwide; shoulders narrow, rounded to oblique; beaks 2 to 10 mm. long; awns 3 to 8 cm. long; kernels white, midlong, soft, ovate to elliptical; germ small; crease narrow, middeep; cheeks rounded; brush small, midlong.

History.—Requa (C. I. 11554) was developed from heads selected in 1926 from a field of Turkey by E. Requa, a farmer living near Pomeroy, Wash. The original increase that was distributed about 1931 consisted of a mixture of red and white kernels. Mr. Requa selected, increased, and distributed a white-grain type about 1935. Characteristics of the selection and the fact that Mr. Requa grew Goldcoin in the hay strip around his fields suggest that Requa was from a natural cross between Turkey and Goldcoin.

Distribution.—Estimated area in 1949, 112,060 acres, grown in Washington, Oregon, and Idaho.

SEVIER

Description.—Plant spring habit, midseason, midtall; stem white, slender, weak to midstrong; spike awned, somewhat laterally compressed, oblong, dense, erect to inclined; glumes glabrous, light brown, midlong, midwide; shoulders midwide, oblique; beaks 1 to 3 mm. long; awns 2 to 6 cm. long; kernels white, midlong, hard, ovate, humped; germ midsized; crease midwide, shallow; cheeks angular; brush midsized, midlong.

Sevier is not pure as commercially grown. It is very distinct and peculiar, as it represents an almost intermediate form between common and durum wheat, and for that reason it also somewhat resembles poulard wheat. It has the laterally compressed spike, sharply keeled glumes, and large hard kernels of durum and the short, hollow stem, short awns, and midlong brush of common wheat.

History.—The origin of Sevier (C. I. 6247) (reg. 168) is undetermined. It may be the result of a natural field hybrid between common and durum wheat. It was first recorded as commercially grown in Utah by Stewart (*199, p. 385*) in the summer of 1918 and first listed as Kubanka durum wheat. It was found not to be Kubanka and was also determined to be more nearly a common than a durum wheat. As the variety had been grown in Sevier County, Utah, for 25 years or more, it was named Sevier by Stewart (*198, p. 25*).

Distribution.—Estimated area in 1949, 1,002 acres, grown in Utah.

GOENS

Description.—Plant winter habit, early to midseason, midtall; stem faintly purple, strong; spike awned, fusiform, middense, inclined, easily shattered; glumes glabrous, brown, midlong to long, midwide; shoulders narrow, usually oblique; beaks 1 to 3 mm. long; awns 2 to 7 cm. long; kernels red, midlong, soft, ovate; germ midsized to large; crease midwide, middeep to deep, sometimes pitted; cheeks usually rounded; brush midsized, midlong.

History.—Goens (C. I. 4857) (reg. 172), under the names "Red Chaff" and "Red Chaff Bearded," has long been known in the United States. According to Klippart (*124, p. 739*), this wheat was "cultivated in Clermont county [Ohio] for upward of 50 years." In his report, which was written in 1857, he further states that the origin of the name Goens is undetermined. It "was introduced into Muskingum County [Ohio] by John Dent, in 1808." The Red Chaff wheat mentioned above, however, may be only the Mediterranean variety, as Goens has been said to be a cross between Mediterranean and Gipsy made by a man named Goens in Ohio and afterward developed by his son. Concerning the introduction of the variety into Shelby County, Ind.,

FIGURE 97.—*A*, Goens and *B*, Mediterranean wheats: Spikes and glumes, × 1; kernels, × 3.

Russell G. East, county agent, Shelbyville, Ind., has written as follows:[13]

> Answering your inquiry regarding Shelby Red Chaff wheat. The year 1887 a man named Hall, living at Fountaintown, in this county, purchased a carload of wheat in Paulding County, Ohio. From this start this variety has become the common variety grown throughout the county and has been known locally as Hall, Red Hall, Red Chaff, and Red Chaff Bearded.

Distribution.—Estimated area in 1949, 110,470 acres, grown in Ohio, Indiana, Illinois, Missouri, and Kentucky.

Synonyms.—Baldwin, Cummings, Dunlap, Early Red, Early Ripe, Going, Hall, Owen, Red Chaff, Red Chaff Bearded, Red Hall, Red Rudy, Shelby Red Chaff.

PRAIRIE

Description.—Plant winter habit, midseason, midtall; stem white, strong; spike awned, fusiform, middense, inclined; glumes glabrous, brown, midlong, narrow to midwide; shoulders narrow to wanting; beaks narrow, 5 to 8 mm. long; awns 5 to 10 cm. long; kernels red, short to midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Prairie is resistant to mosaic and moderately resistant to stem rust but is susceptible to loose smut. It is winter-hardy and has good straw and good soft-wheat quality.

History.—Prairie (C. I. 12371) was developed from one of 250 mosaic-resistant plants selected in 1935 from a field of Illinois No. 2 on the farm of Ralph Allen, Delavan, Ill. The selection that resulted in Prairie was designated as D47. In 1940, 400 head rows from D47 were grown and found to differ in resistance to stem rust, strength of straw, and other characters. Seven outstanding strains were bulked for planting in the fall of 1942, and foundation seed increased from these was distributed in the fall of 1943 (*23*).

Distribution.—Estimated area in 1949, 44,945 acres, grown in Illinois, Indiana, and Missouri.

IOBRED

Description.—Plant winter habit, midseason to late, midtall to tall; stem white, midstrong; spike awned, fusiform, middense, erect to inclined, easily shattered; glumes glabrous, brown, sometimes black, midlong, narrow to midwide; shoulders narrow to midwide, rounded to elevated; beaks 2 to 10 mm. long; awns 3 to 8 cm. long; kernels red, short, hard, ovate; germ midsized; crease midwide, middeep; brush midsized, midlong.

Iobred is moderately resistant to leaf and stem rust, but is susceptible to shattering.

History.—Iobred (C. I. 6934) (reg. 236) was produced at the Iowa Agricultural Experiment Station, Ames, in cooperation with the Division of Cereal Crops and Diseases. It is a selection of Banat (Iowa No. 1661) made in 1915. It was first distributed for commercial growing in 1923.

Distribution.—Estimated area in 1949, 68,427 acres, grown in seven States, the largest acreages being in Kansas, Iowa, and Nebraska.

Synonyms.—Hybred, Iowa Bred, Red Russian.

IOHARDI

Description.—Plant winter habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, brown, midlong, midwide; shoulders wanting to oblique; beaks 8 to 15 mm. long; awns 3 to 8 cm. long; kernels red, short to midlong, hard, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Iohardi is more winter-hardy than Iobred and has the stiff straw and stem-rust resistance of that parent. It is similar to Turkey in date of maturity. It gives good yields and has a good test weight and acceptable milling and bread-baking quality.

History.—Iohardi (C. I. 12510) was developed at the Iowa Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases from a cross made in 1935 between Iobred and Minhardi (*30*). During the testing period it was designated as I–M516. It was distributed in the fall of 1948.

Distribution.—Estimated area in 1949, 449 acres, grown in Iowa.

BRILL

Description.—Plant winter habit, early to midseason, short to midtall; stem white and purple, weak; spike awned, fusiform, middense, inclined to nodding; glumes glabrous, yellowish brown, midlong, narrow; shoulders wanting to rounded; beaks 1 to 5 mm. long; awns 3 to 6 cm. long; kernels red, midlong, hard, elliptical; germ midsized; crease midwide,

[13] Correspondence of the Division of Cereal Crops and Diseases. March 1, 1922.

shallow to middeep; cheeks rounded; brush midsized, midlong.

Brill is somewhat resistant to yellow berry, scab, leaf rust, stem rust, flag smut, and winter injury. It is susceptible to mosaic.

History.—Brill (C. I. 11853) was the best of 6,000 selections made from Turkey in 1922 in cooperative investigations between the Illinois Agricultural Experiment Station and the Division of Cereal Crops and Diseases at Urbana. The selections were made as part of a search for strains resistant to scab. Brill was designated as Illinois No. 131 until it was named and distributed in the fall of 1936.

Distribution.—Estimated area in 1949, 71,396 acres, grown in nine States, the largest acreage being in Illinois.

RED JACKET

Description.—Red Jacket is similar to Blue Jacket, except that its glumes are brown with black instead of white with the black. Limited tests indicate that its breadbaking quality is poor compared with fair or acceptable for Blue Jacket. It is low in water absorption and short in doughmixing time.

History.—Red Jacket (C. I. 12713) was developed by the farmer-wheat breeder, E. G. Clark of Sedgwick, Kans., as Clark sel. 44–13. It was distributed by him in 1950.

REDHULL

Description.—As commercially grown, Redhull is a mixed type of hard red winter wheat. The predominating type is awned and has brown glumes with black stripes.

History.—Redhull (C. I. 11534) (reg. 304) is reported to have been developed from a brown-glumed selection from a field of Blackhull at Haven, Kans., by F. E. Tonn in 1921.[14] Seed was increased and sold by R. M. Woodruff, of Pratt, Kans.

Distribution.—Estimated area in 1949, 15,285 acres, grown in Oklahoma, Colorado, and Wyoming.

Synonyms.—Bartels Best, Bronze Turkey, Cleathers Red, Conoway, Ironclad Blackhull, Nick Special, Red Chaff, Rupp.

DENTON

Description.—Denton differs from Mediterranean principally in having white stems. It is taller, has stiffer stems and a denser spike, and is resistant to some races of leaf rust.

History.—Denton (C. I. 8265) (reg. 255) was developed (*132*) by the Texas Agricultural Experiment Station at Substation No. 6, from a plant selected from Mediterranean in 1918. The variety was distributed for commercial growing in 1926.

Distribution.—Estimated area in 1949, 2,100 acres, grown in Colorado, Texas, and Oklahoma.

MEDITERRANEAN

Description.—Plant winter habit, midseason, tall; stem purple, weak to mid-

[14] Woodruff, R. M., 23-page pamphlet on wheat varieties. No date. Pratt, Kans.

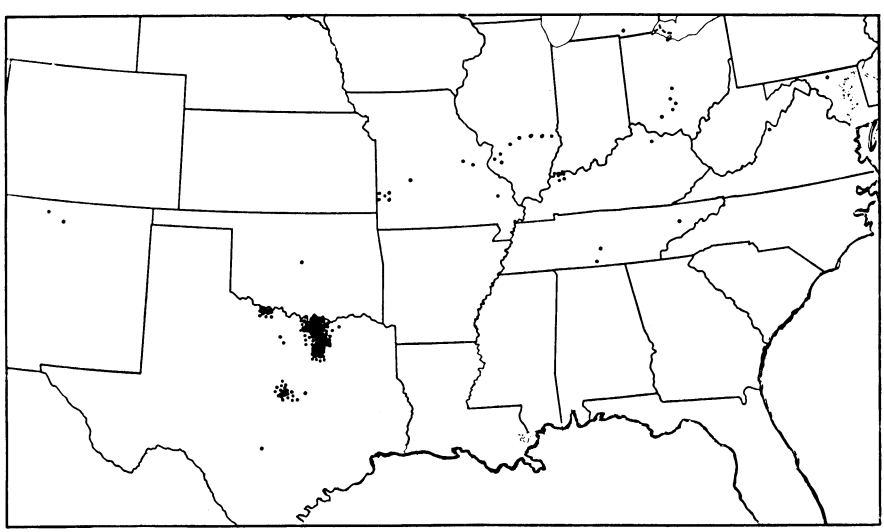

FIGURE 98.—Distribution of Mediterranean wheat in 1949. Estimated area, 252,145 acres.

strong, coarse; spike awned, fusiform, middense to lax, erect to inclined, easily shattered; glumes glabrous, brown, long, midwide; shoulders wanting to narrow, rounded to oblique; beaks 1 to 8 mm. long; awns 3 to 8 cm. long; kernels red, long, soft, elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong. (See fig. 97, *B*.)

History.—Reference to the Mediterranean (C. I. 5303) (reg. 180) variety in American literature begins in 1842, when the variety was widely grown, with the statement that it had been introduced some years before. One writer says (*92, p. 228*) it was introduced into Maryland from the Mediterranean Sea region in 1837. In 1863 it was recorded (*136, p. 501*) that it was introduced in 1819 from Genoa, Italy, by John Gordon, of Wilmington, Del. It came into prominence in New York between 1845 and 1855, from which time its culture spread rapidly westward. Its early popularity apparently was gained because it was more resistant to hessian fly damage than other varieties. It was found also to be several days earlier than the winter wheats commonly grown at that time, such as Bluestem, Red Bluestem, and Golden Straw. It was called rust resistant and was recommended as being a high yielder of especially heavy grain and adapted to poorer soils than most varieties. White wheats being the standard, it was vigorously criticized, especially by millers because its red kernels yielded a dark flour and because of the thickness of the bran. This disapproval persisted for at least 25 years, but after the introduction of roller mills it became recognized as a good milling wheat.

Distribution.—Estimated area in 1949, 252,145 acres (fig. 98).

Synonyms.—Acme, Bluestem, Farmers Trust, Key's Prolific, Lancaster Red, Lehigh, Miller, Missouri Bluestem, Mortgage Lifter, Red Chaff, Red Mediterranean, Red Sea, Red Top, Standby, Swamp.

RED ROCK

Description.—Red Rock is similar to Mediterranean except for having stronger stems; a slightly longer, wider, and laxer spike; and a harder kernel with a wider and deeper crease. It is resistant to flag smut.

History.—Red Rock (C. I. 5597) (reg. 181) was originated at the Michigan Agricultural Experiment Station from an individual kernel picked out of a white wheat called Plymouth Rock. The selection was first sown in the fall of 1908. In 1914, 60 bushels were sent out by the experiment station to as many farmers, 1 bushel being furnished each farmer (*195*).

Distribution.—Estimated area in 1949, 14,266 acres, grown in Michigan.

AUSTIN

Description.—Plant intermediate habit, midseason to late, tall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, brown, midlong, narrow to midwide; shoulders wanting to narrow; beaks narrow, acuminate, 5 to 8 mm. long; awns 5 to 8 cm. long; kernels red, midlong, soft, ovate; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized to large, midlong.

Austin is resistant to many races of stem rust and loose smut and to some races of leaf rust. It has a semi-erect-growth habit and is not winter-hardy north of Texas. It is similar to Mediterranean in quality.

History.—Austin (C. I. 12346) (reg. 342) was developed from a cross between Mediterranean and Hope made in 1928 at the Texas Agricultural Experiment Station at College Station, in cooperation with the Division of Cereal Crops and Diseases. Bulk hybrid populations were grown at Texas substations for several generations and at the Kansas and Nebraska stations in 1934 and 1935 in order to eliminate the more winter-tender types before selections were made. A selection, designated as 41–16–3–3 during the testing period, was named Austin and distributed to Texas wheat growers in 1942. It reached its largest acreage in 1946 when an estimated 750,000

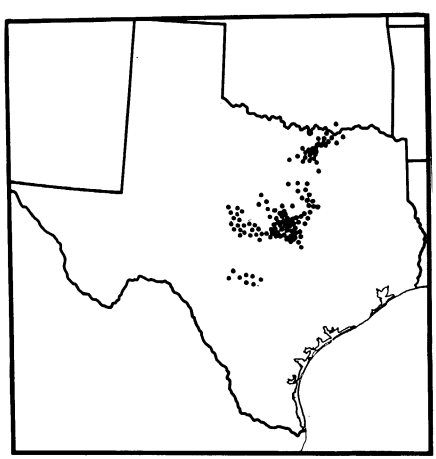

FIGURE 99.—Distribution of Austin wheat in 1949. Estimated area, 218,211 acres.

acres were grown. It was recommended for growing in the area south of Dallas and Fort Worth, Tex. Its value in the control of the rusts has decreased since the appearance of new races to which it is susceptible.

Distribution.—Estimated area in 1949, 218,211 acres, grown in Texas and Oklahoma (fig. 99).

KENTANA

Description.—Plant spring habit, early to midseason, midtall; stem white, midstrong to strong; spike awned, fusiform to oblong, middense, inclined; glumes glabrous, brown, long, midwide; shoulder narrow, wanting to elevated; beak narrow, acuminate, 3 mm. long; kernels red, midlong, soft to semihard, ovate to elliptical; germ midsized; crease midwide, middeep; cheeks rounded; brush midsized, midlong.

Kentana is a high-yielding variety in Mexico, especially from fall seeding. It is highly resistant to the races of stem rust prevalent in the Western Hemisphere, including race 15B, and is moderately resistant to stripe rust, but is susceptible to leaf rust. It is a true spring variety and is not winter-hardy.

History.—Kentana was developed in the wheat-improvement program of the Oficina de Estudios Especiales of the Secretaria de Agricultura y Ganaderia of Mexico in collaboration with the Rockefeller Foundation. It resulted from a cross between Kenya C9906, P. I. 118896, R. F. 324, and Mentana, made at Chapingo, Mexico, in the spring of 1945. By growing two generations each year and selecting only stem-rust-resistant plants, F_5 lines pure for resistance to stem rust were grown during the summer of 1947. The best of these were entered in yield trials in four regional nurseries in the fall of 1947. Yield trials from both fall and spring plantings were made each year. The first field increase was made in the winter crop of 1948–49. Following further testing for rust reaction and adaptation, Kentana was increased under control in the summer of 1949. It was released for seeding in commercial increase fields in the four major wheat-growing regions of Mexico for the winter crop of 1949–50. Thus the variety was growing on commercial increase fields in the F_{10} generation just 5 years after the cross was made.

Kentana, grown in commercial fields in the summer of 1951, showed only subepidermal pustules of stem rust when adjacent fields of Supremo, which had been resistant to all races of stem rust prevalent in North America except race 15B, were so badly damaged by rust that they were not harvested. Beginning with the summer crop of 1952, Kentana constituted a major part of the wheat crop in Mexico and should greatly reduce the amount of inoculum of race 15B that may overwinter in Mexico and southern Texas. This will greatly reduce the danger of epidemics of race 15B in the wheat-growing areas of the United States and Canada.

Kentana was estimated grown on 40,000 acres in Mexico in the winter crop of 1951–52. A few bushels were brought to southern Texas and planted in the fall of 1951.

SUPREMO

Description.—Plant spring habit, midseason, midtall; stem white, midstrong; spike awned, fusiform to oblong, middense, inclined; glumes glabrous, brown, midlong to long, midwide; shoulders wanting to narrow; beaks narrow, acuminate, 3 to 5 mm. long; awns 2 to 6 cm. long; kernels red, midlong to long, soft to semihard, elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush midsized, midlong.

Supremo is very resistant to stem rust (except race 15B), leaf rust, stripe rust, and loose smut. It has produced well in central and northern Mexico and in southern Texas. It is not winter-hardy and should not be grown north of Temple, Tex. The variety is somewhat susceptible to shattering in dry windy areas.

History.—Supremo (C. I. 12531) (Rocamex 211) was developed from the cross Surpresa × (Hope-Mediterranean) made at College Station, Tex., in 1936 in work cooperative between the Division of Cereal Crops and Diseases and the Texas Agricultural Experiment Station. The Rockefeller Foundation, in cooperation with the Mexican Ministry of Agriculture, obtained several lines from College Station in 1944 for testing in Mexico. Selection 3651–29–1 from the above cross was very promising and after being further purified was distributed in Mexico in 1948 as Supremo (*24*). Fifty bushels of seed were returned to southern Texas for seeding in the fall of 1949. It is estimated that 250,000 acres were grown in Mexico in 1950.

Club Wheat

The plants of club wheat may be of either winter or spring habit and either tall or short. The stems usually are stiff and strong. The spikes usually are awnless but may be awned, and are elliptical, oblong, or sometimes clavate or club-shaped, short, usually less than 2½ inches in length, very compact, and laterally

compressed. The spikelets usually contain five fertile florets and spread at nearly a right angle to the rachis. The kernels of club wheat are small and laterally compressed or "pinched" because of crowding in the compact spikes. Most club wheat kernels have a small, short brush and a narrow, very shallow crease. The grain may be either white or red and that of most varieties is of rather poor quality for breadmaking and is used largely for cake and pastry flours.

The club wheats are distinguished from common wheats by the shorter and denser, laterally compressed spikes. The varieties of wheat grown in the eastern part of the United States often referred to as club because of having clavate spikes do not belong to this group, but are common wheats.

Distribution of club wheats in the United States in 1949 is shown in figure 100.

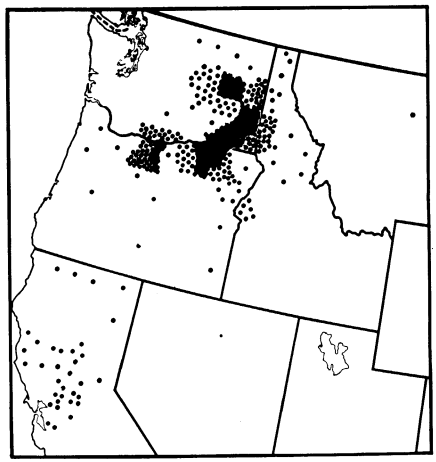

FIGURE 100.—Distribution of club wheats in 1949. Estimated area, 1,256,544 acres.

KEY TO THE VARIETIES OF CLUB WHEAT

		Page
1a. Spike awnleted.		
2a. Glumes glabrous.		
3a. Glumes white.		
4a. Kernels white (*T. compactum humboldtii* (Koern.) Stol.).		
Kernels soft to semihard.		
Winter habit.		
Awnlets 1 to 5 mm. long; plant short.		
Stem white and purple; susceptible to bunt	Alicel	148
Stem white.		
Susceptible to bunt	Elgin	149
Resistant to bunt	Elmar	149
Awnlets 2 to 10 mm. long; plant midtall to tall	Hybrid 128	149
Awnlets 3 to 15 mm. long; plant midtall to tall	Hymar	149
	Albit	150
Spring habit.		
Plant short, early; spike oblong to clavate	Poso 48	150
Plant midtall to tall, midseason; spike elliptical to clavate	Big Club 43	150
Kernels semihard to hard.		
Spring intermediate habit.		
Spike elliptical to oblong	Hybrid 63	150
3b. Glumes brown.		
4a. Kernels white (*T. compactum rufulum* (Koern.) Stol.).		
Kernels soft to semihard.		
Spring habit.		
Spike oblong to fusiform; glumes dark brown	Jenkin	151
Spike elliptical to clavate.		
Glumes light brown	Redchaff	151
1b. Spike awned.		
2a. Glumes glabrous.		
3a. Glumes white.		
4a. Kernels white (*T. compactum erinaceum* (Hornem.) Koern.).		
Kernels semihard to hard.		
Spring intermediate habit	Utac	151

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONYMY OF CLUB WHEAT VARIETIES

ALICEL

Description.—Plant winter habit, midseason, short; stem white and purple, very strong; spike awnleted, elliptical, very dense, erect; glumes glabrous, white, short, narrow to midwide; shoulders wanting to narrow, oblique; beaks midwide, obtuse, 0.5 mm. long; awnlets wanting to few, 1 to 5 mm. long; kernels white, short, soft, ovate, irregular, humped, flattened; germ small to midsized; crease narrow, shallow; cheeks rounded to angular; brush midsized, midlong.

Alicel is very susceptible to bunt.

History.—Alicel (C. I. 11700) was developed in cooperative investigations of the Division of Cereal Crops and Diseases and the Oregon Agricultural Experiment Station, from a cross between Goldcoin and Hybrid 128 made at the

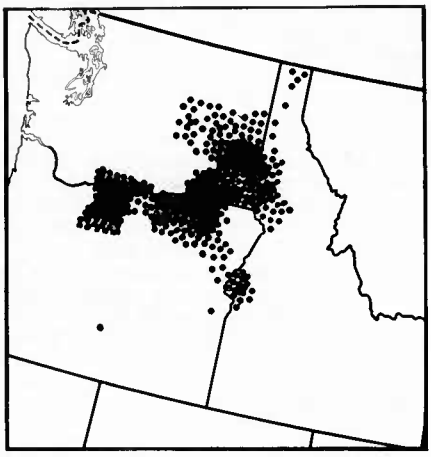

FIGURE 101.—Distribution of Alicel and Elgin wheats in 1949. Estimated area, 830,096 acres.

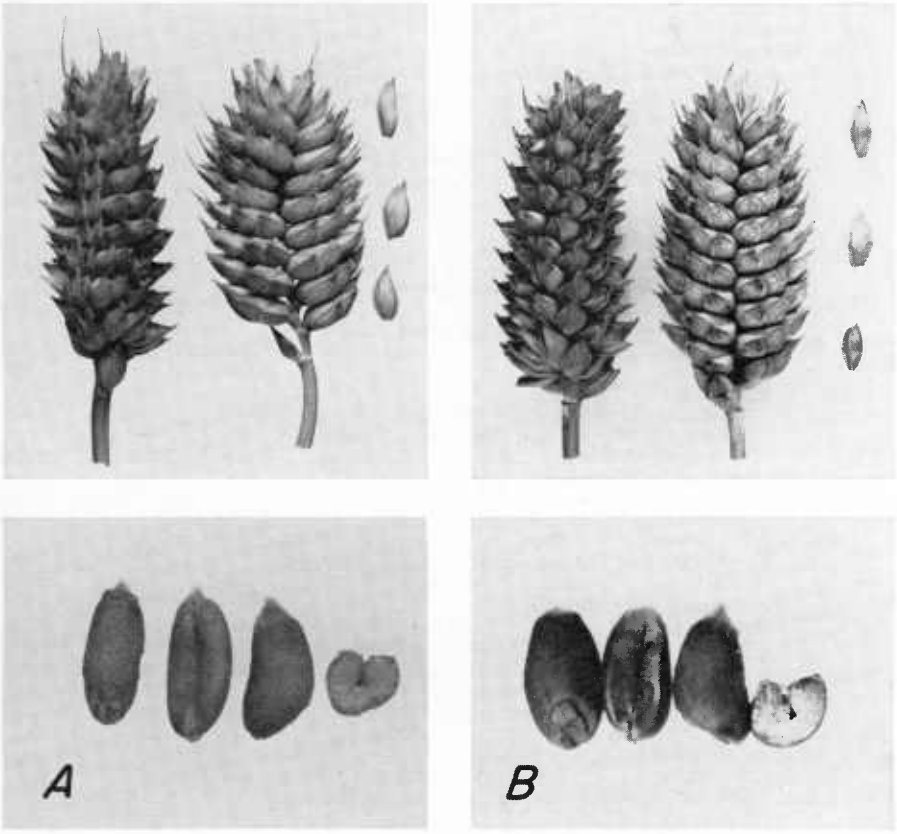

FIGURE 102.—*A*, Elgin and *B*, Hybrid 128 wheats: Spikes and glumes, × 1; kernels, × 3.

Sherman Branch Experiment Station in 1919. Selection 1998A5–1–1 made in 1924 was distributed in the Grande Ronde Valley in eastern Oregon in the fall of 1932.

Distribution.—Estimated area in 1949, 233,803 acres (fig. 101). Since Alicel and Elgin are so similar and Elgin is replacing Alicel, the acreage of the two varieties is combined.

ELGIN

Description.—Elgin is very similar to Alicel except in being more uniform and in having white stems. It is a very productive club wheat with short, stiff straw and excellent milling and soft-wheat baking quality. It is very susceptible to bunt. (See fig. 102, *A*.)

History.—Elgin (C. I. 11755), a selection made from Alicel in 1932 at the Pendleton Branch Experiment Station, Pendleton, Oreg., is more uniform in plant height and color of straw than Alicel and has largely replaced that variety.

Distribution.—Estimated area in 1949, 596,293 acres, grown in four States (fig. 101).

ELMAR

Description.—Elmar is practically identical with Elgin in plant characteristics and in yield. It has the bunt resistance of Hymar, which includes that to dwarf bunt and to several races of common bunt. It is similar to Elgin in milling behavior but slightly inferior in baking quality.

History.—Elmar (C. I. 12392) was developed from a cross of Hymar-Elgin backcrossed twice to Elgin. The first cross was made in 1942 and the backcrosses were made in 1943 and in 1944 at Pullman, Wash. The most bunt-resistant F_3 progeny was thereafter increased and distributed in the fall of 1949 by the Washington Agricultural Experiment Station in cooperation with the United States Department of Agriculture. (*217*). Approximately 400 bushels were distributed in Washington, 50 bushels in Idaho by the Idaho Agricultural Experiment Station, and 50 bushels in Oregon by the Oregon Agricultural Experiment Station.

HYBRID 128

Description.—Plant winter habit, midseason, midtall to tall; stem white, strong; spike awnleted, elliptical, dense, erect; glumes glabrous, white, short, wide; shoulders narrow, usually rounded; beaks wide, obtuse, 0.5 mm. long; awnlets few, 2 to 10 mm. long; kernels white, short, soft, ovate to oval, irregular, humped; germ midsized; crease midwide, shallow; cheeks angular; brush small, midlong. (See fig. 102, *B*.)

Hybrid 128 is very susceptible to bunt.

History.—Hybrid 128 (C. I. 4512) (reg. 190) was originated at the Washington Agricultural Experiment Station, Pullman. Its history has been recorded by Schafer and Gaines (*178, p. 8*) as follows:

> Hybrid 128 is a cross between Jones Winter Fife and Little Club. It was originated in 1899 by Prof. W. J. Spillman. After being selected and tested for 8 years, it was distributed to ranchers for further testing.

Professor Spillman started his work in wheat breeding at the Washington Agricultural Experiment Station in 1899. Valuable results were obtained, Hybrid 128 being only one of the varieties that resulted from the first crosses. The work was hardly commenced before he left the station, and the important task of making the selections, testing the many strains, and distributing the new varieties was left to other workers. His work with wheat, however, resulted in some of the very earliest discoveries of the fundamental principles of heredity in plant breeding. He left Pullman in June 1902, and it was not until 1909 that he published the results of his studies in hybridization (*193*). In the same year he published a more popular bulletin from the Washington Agricultural Experiment Station, which gave some of the results of his early experiments (*194*).

Distribution.—Estimated area in 1949, 77,899 acres, grown in Washington, Oregon, and Idaho.

HYMAR

Description.—Hymar is very similar to Hybrid 128 except in having slightly more and longer awnlets and in being slightly later. It is resistant to several races of bunt.

History.—Hymar (C. I. 11605) (reg. 314) was developed in cooperative ex-

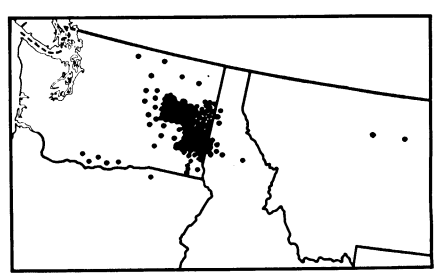

FIGURE 103.—Distribution of Hymar wheat in 1949. Estimated area, 269,880 acres.

periments of the Washington Agricultural Experiment Station and the Division of Cereal Crops and Diseases. It is the result of a cross between Hybrid 128 and Martin made in 1923. The plant selection that resulted in Hymar was made in 1930. It was distributed for commercial production in the fall of 1935.

Distribution.—Estimated area in 1949, 269,880 acres, grown in Washington, Idaho, Montana, and Oregon (fig. 103).

ALBIT

Description.—Albit differs from Hybrid 128 in having slightly longer spikes, less harsh glumes, slightly longer awnlets (3 to 15 mm. long), and sometimes lighter green leaves. It is resistant to some races of bunt but has a slightly lower test weight and is more susceptible to shattering than is Hybrid 128.

History.—Albit (C. I. 8275) (reg. 258) was developed by the Washington Agricultural Experiment Station in experiments cooperative with the Division of Cereal Crops and Diseases, from a cross made in 1920 between Hybrid 128 and White Odessa (C. I. 4655). The selection, later named Albit, was made in 1923 and released for commercial production in the fall of 1926.

Distribution.—Estimated area in 1949, 5,943 acres, grown in Washington, Idaho, and Oregon.

POSO 48

Description.—Plant spring habit, early, short; stem white, strong; spike awnleted, dense, oblong to clavate; glumes glabrous, white (sometimes light brown striped), midlong, midwide; shoulders midwide, rounded; beaks wide, obtuse, 0.5 mm. long; awnlets few, 3 to 15 mm. long; kernels white, short, soft, ovate, humped, truncate; germ midlarge to large; crease narrow, shallow; cheeks rounded; brush large, short.

Poso 48 is resistant to several races of bunt and stem rust and is mixed for resistance to hessian fly but is otherwise similar to Poso. It has largely replaced the original Poso and other improved strains of that variety.

History.—Poso 48 (C. I. 12691) was developed in the backcrossing program of the California Agricultural Experiment Station at Davis in cooperation with the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, and Division of Cereal and Forage Insect Investigations, Bureau of Entomology and Plant Quarantine. It is a composite of 197 F_7 lines derived from [(Hope-Baart[4] × Poso[3]) × Poso 41[2]] × Poso 42. Poso 41 was derived from Martin-White Federation[3] × Poso[6], and Poso 42 from Dawson × Poso[6]. Poso 44 distributed in the fall of 1945 is no longer grown on a significant acreage. It was a composite of 67 F_3 lines derived from (Dawson × Poso[6]) × (Hope-Baart[4] × Poso[3]) grown in 1944. Poso 48 was distributed in the fall of 1948 and comprises most of the Poso acreage now grown.

Distribution.—Estimated area in 1949, 14,984 acres, grown in California and Utah. This acreage includes all strains of Poso.

BIG CLUB 43

Description.—Plant spring habit, midseason, midtall to tall; stem white, strong; peduncle curved; spike awnleted, elliptical to clavate, dense, erect; glumes glabrous, white, midlong, midwide; shoulders midwide, usually rounded; beaks wide, obtuse, 0.5 mm. long; awnlets few, 2 to 5 mm. long; kernels white, short, soft, nearly oval, humped; germ small; crease narrow, shallow; cheeks usually angular; brush small, midlong. Big Club 43 is very similar to Big Club except in being resistant to some races of bunt, stem rust, and hessian fly. It has replaced Big Club and Big Club 37.

History.—Big Club 43 (C. I. 12244) was developed in the backcrossing program of the California Agricultural Experiment Station at Davis in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering, and the Bureau of Entomology and Plant Quarantine. [(Hope × Baart[4]) × Big Club[2]] × (Martin × Big Club[7])[2] was crossed on (Dawson × Big Club[4]) × (Martin × Big Club[7])[2]. A composite of 144 F_3 lines selected for resistance to bunt, stem rust, and hessian fly was increased for distribution in 1944.

Distribution.—Estimated area in 1949, 40,048 acres, grown in California and Utah.

HYBRID 63

Description.—Plant spring intermediate habit, midseason to late, midtall; stem white, strong; spike awnleted, elliptical to oblong, dense, erect; glumes glabrous, white, midlong, narrow to midwide; shoulders midwide, usually rounded; beaks wide, obtuse, 0.5 mm. long; awnlets few, 3 to 20 mm. long; kernels white, short, semihard to hard, ovate to elliptical, humped; germ small; crease narrow, shallow; cheeks rounded to angular; brush small, midlong.

Hybrid 63 is winter-hardy and is distinguished by its rather long narrow glumes and semihard to hard kernels.

History.—Hybrid 63 (C. I. 4510) (reg.

195) was originated at the Washington Agricultural Experiment Station. It is of hybrid origin, being selected from a cross made by W. J. Spillman in 1899 between Turkey and Little Club. The variety was distributed to farmers in 1907 by the Washington station. Although it is a spring wheat, it usually has been grown from fall sowing.

Distribution.—Estimated area in 1949, 242 acres, grown in Oregon.

Synonym.—Turkey Hybrid.

JENKIN

Description.—Plant spring habit, late, tall; stem white, strong; spike awnleted, oblong to fusiform, dense, erect; glumes glabrous, brown, midlong, midwide; shoulders midwide, usually rounded; beaks broad, obtuse, 0.5 mm. long; awnlets few, 2 to 10 mm. long; kernels white, short, soft, broadly ovate, humped; germ small; crease midwide, middeep to deep, sometimes pitted; cheeks angular to rounded; brush small, midlong.

History.—The origin of Jenkin (C. I. 5177) (reg. 198) is undetermined. It is known to have been grown in the vicinity of Wilbur, Lincoln County, Wash., about 1895 (*113*). By 1900 it was grown around Walla Walla, Wash., and Pendleton, Oreg., and during the next decade it largely replaced other varieties in those sections, being grown from both fall and spring sowing. In this area Jenkin has now largely been replaced by Federation, Rex, and Elgin.

Distribution.—Estimated area in 1949, 16,887 acres, grown in Idaho, Washington, and Oregon.

REDCHAFF

Description.—Plant spring habit, midseason to late, midtall; stem white, strong; spike awnleted, elliptical to clavate, dense, erect; glumes glabrous, light brown, midlong, midwide; shoulders midwide, usually oblique; beaks wide, obtuse, 0.5 mm. long; awnlets few, 2 to 10 mm. long; kernels white, short, soft, ovate, humped; germ small, abrupt; crease midwide, shallow; cheeks usually angular; brush small, midlong.

Redchaff differs from Jenkin in being shorter and earlier and in having a more clavate spike and lighter brown glumes.

History.—The origin of Redchaff (C. I. 4241) (reg. 199) is undetermined. According to Hunter (*112*), it was an important variety of club wheat in the Columbia Basin of Oregon and Washington in 1907.

Distribution.—Not reported grown in 1949.

Synonyms.—Oregon Red Chaff, Red Chaff Club.

UTAC

Description.—Plant spring intermediate habit, midseason to late, midtall to tall; stem white, midstrong; spike awned, elliptical, dense, erect to inclined; glumes glabrous, white, midlong, midwide; shoulders narrow, wanting to oblique; beaks 1 to 5 mm. long; awns 2 to 5 cm. long; kernels white, midlong, semihard to hard, ovate, humped; germ midsized; crease wide, middeep to deep; cheeks angular; brush midsized, short to midlong.

History.—Utac (C. I. 10045) was developed by the Utah Agricultural Experiment Station at Logan, Utah. It is the result of a cross between Dicklow and Sevier made about 1923. It was distributed to farmers in Utah about 1928.

Distribution.—Estimated area in 1949, 501 acres, grown in Utah.

DURUM WHEAT

The plants of durum wheat are of spring habit. The peduncle is pithy, at

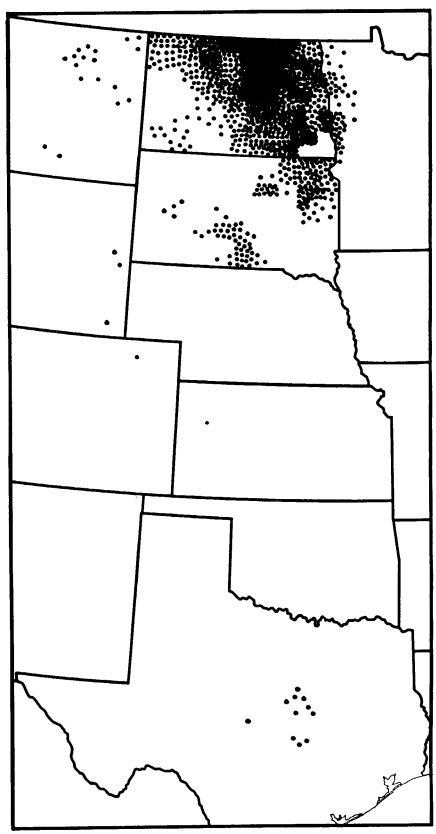

FIGURE 104.—Distribution of durum wheat in 1949. Estimated area, 3,579,196 acres.

least in the upper part. The spikes are compact and laterally compressed, and hence are narrower when seen in a face view. The glumes are sharply keeled, and the lemmas are awned except in a few awnless forms originated by hybridization and which are not in commercial production. The awns are long and coarse and are white, yellow, brown, or black. The kernels are white or red and usually rather long and pointed; they are very hard and translucent, making the white-kerneled forms appear amber-colored. The kernels always have a short brush and angular cheeks and are the hardest of all known wheats.

The durum wheats, as already stated, are sometimes very similar to certain poulard varieties. The spikes, however, usually are much thinner, the glumes are longer, and the kernels are longer, more slender, and usually much harder.

Durum wheat has been widely grown in the United States only since about 1900. The durum wheat area has moved northward until the center of production is in northeastern North Dakota at the present time. The area grown outside of North Dakota has been greatly reduced since 1920. Most of the varieties of durum wheat were introduced from southern Russia and the Mediterranean region, where, exclusive of North America, the largest acreage of this class of wheat is grown. Certain introductions, including Kubanka, made by the United States Department of Agriculture about 1900, became popular with farmers in the northern Great Plains and prairie sections, and production increased rapidly. The distribution of durum wheat in 1949 is shown in figure 104. The durums furnish the great bulk of the world's supply of wheat for the manufacture of semolina, which is made into macaroni, spaghetti, and similar products. The production of durum wheat in the United States has made possible a large macaroni industry.

The varieties that are commercially grown are distinguished by the accompanying key.

KEY TO THE VARIETIES OF DURUM WHEAT

1a. Spike awned.
  2a. Glumes glabrous.
    3a. Glumes white.
      4a. Awns white.
        5a. Kernels red (*Triticum durum affine* (Koern.) Stol.).

		Page
Kernels short to midlong	Pentad	152

      4b. Awns black.
        5a. Kernels white (amber) (*T. durum leucomelan* Diam.).

Kernels very long	Peliss	154

    3b. Glumes yellow.
      4a. Awns white.
        5a. Kernels white (amber) (*T. durum hordeiforme* (Host.) Stol.).
          Kernels midlong.
            Beaks 1 to 2 mm. long.

Plant very early	Nugget	154
Plant early	Vernum	154
Plant late.		
Spike oblong to fusiform, middense	Stewart	155
Spike oblong, dense	Carleton	155
	Kubanka	156

            Beaks 1 to 5 mm. long.
              Plant late.

Spike oblong fusiform, middense	Arnautka	156
	Mindum	158

DESCRIPTION, HISTORY, DISTRIBUTION, AND SYNONYMY OF DURUM WHEAT VARIETIES

PENTAD (D–5)

Description.—Plant spring habit, midseason, midtall; stem white, midstrong; spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders midwide, oblique to elevated; beaks 1 to 2 mm. long; awns white, 5 to 15 cm. long; kernels red, short to midlong, hard, ovate, truncate tip, humped; germ midsized; crease midwide, shallow; cheeks angular; brush midsized, short. (See fig. 105, *A*).

Pentad is distinct from all other commercial varieties of durum wheat grown

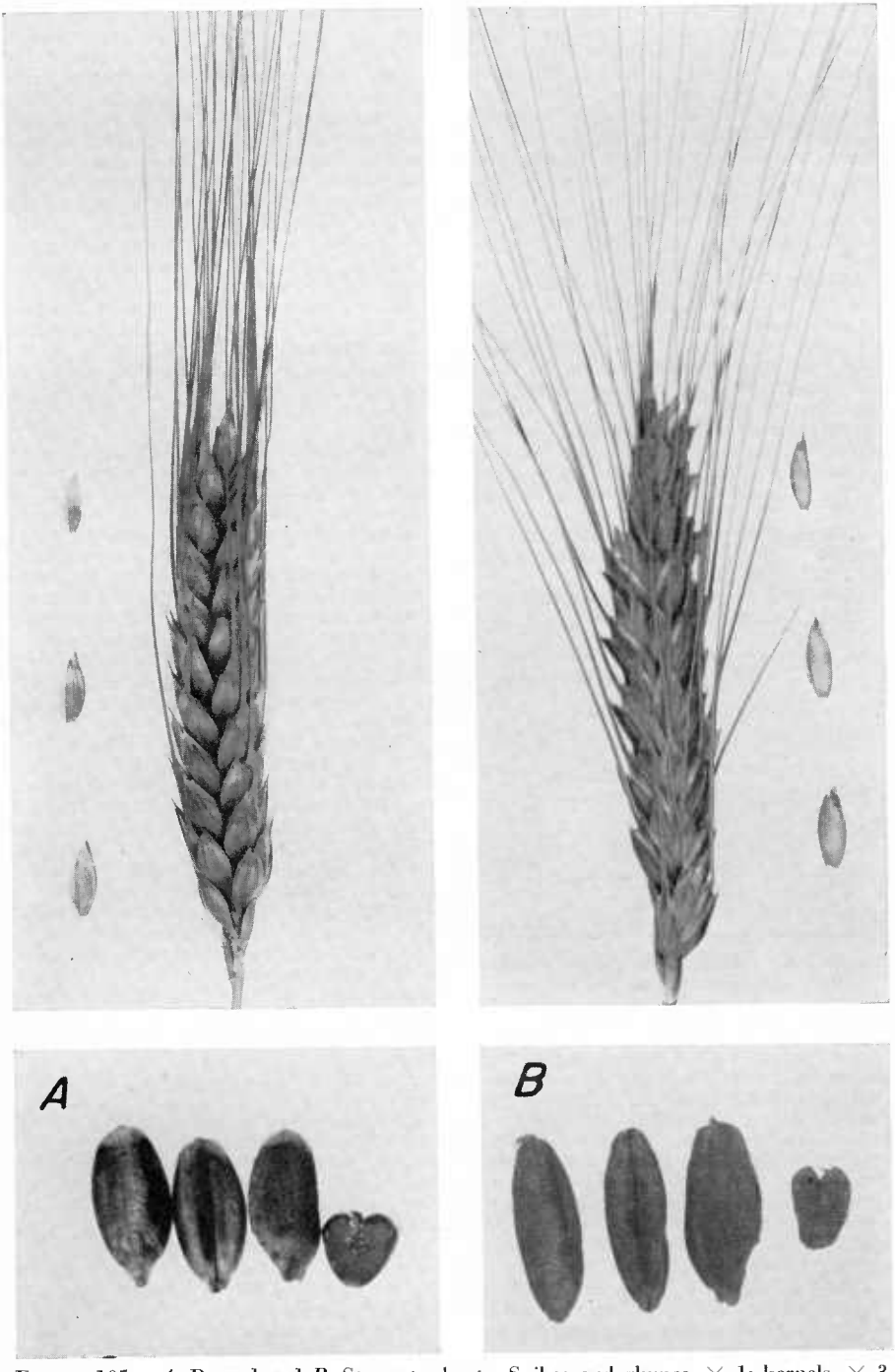

FIGURE 105.—*A*, Pentad and *B*, Stewart wheats: Spikes and glumes, × 1; kernels, × 3.

in the United States because of its red kernels. The kernels are smaller, more nearly square at the brush end and more pointed at the germ end than kernels of the other durum varieties. Prior to the development of Carleton and Stewart it was the most rust-resistant variety of the durum wheats grown in the United States, and therefore it yielded well under conditions favoring rust. Its quality is inferior, however, to that of the amber durum varieties. It is used largely for feed.

History.—Pentad (C. I. 3322) (reg. 209) was introduced from Russia in 1903 by the North Dakota Agricultural Experiment Station. It was distributed in North Dakota in 1911. Because of its rust resistance it gained popularity and has been widely grown in the spring-wheat area from late seeding. Because of its poor quality its production has been opposed by many agencies. The name Pentad was first recorded in 1920 (*153, p. 17*).

Distribution.—Estimated area in 1949, 288,762 acres, grown in five States (fig. 106).

Synonyms.—D–5, D–fife, Durum No. 5, Ladd Durum, Red Durum.

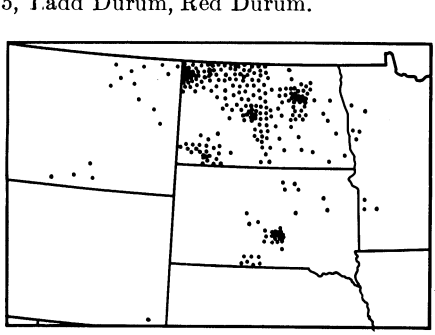

FIGURE 106.—Distribution of Pentad wheat in 1949. Estimated area, 288,762 acres.

PELISS

Description.—Plant spring habit, midseason, tall; stem white, midstrong; spike awned, broadly fusiform, middense, inclined; glumes glabrous, white, long, wide; shoulders narrow to midwide, oblique to elevated; beaks 1 to 5 mm. long; awns black, 6 to 18 cm. long; kernels white (amber), very long, hard, elliptical, curved, humped; germ midsized; crease midwide, middeep; cheeks angular; brush small, short.

Peliss is distinct from Kubanka in having white rather than yellowish glumes, black awns, and very long kernels that are somewhat curved.

History.—Peliss (C. I. 1584) (reg. 210) (P. I. 5380) was introduced from Mustapha, Algiers, Algeria, by the United States Department of Agriculture, in 1900. The variety was widely distributed throughout northern Africa. According to Scofield (*183, p. 38*), the original seed was obtained from a man named Pelissier, who lived near Ponts des Issers in the western part of the Province of Oran and who improved the yield of this variety by selection. In the United States the variety was first called Pelissier, but the shorter and simpler form Peliss was substituted in 1920.

Distribution.—Estimated area in 1949, 13,478 acres, grown in Montana and South Dakota.

Synonyms.—Black-Bearded Durum, Pelissier.

NUGGET

Description.—Plant spring habit, very early, short to midtall; stem white, weak; spike awned, fusiform, middense, inclined; glumes glabrous, yellow, midlong, midwide; shoulders narrow, rounded; beaks wide, acute, 1 mm. long; awns white, 8 to 16 cm. long; kernels white (amber), midlong, hard, elliptical; germ midsized; crease narrow to midwide, middeep; cheeks rounded; brush small, midlong.

Nugget is an early durum wheat of high quality for making macaroni products. It is not a high-yielding durum variety.

History.—Nugget (C. I. 12620) (Ld. 303) is a result of a cross between Ld. 216 and Ld. 240 developed in cooperative experiments between the North Dakota Agricultural Experiment Station and the Division of Cereal Crops and Diseases at the Langdon and Fargo, N. Dak., stations. The Ld. 216 parent is a selection from Heiti × Stewart and Ld. 240 is a selection from Mindum × Carleton. The earliness and shortness of Nugget come from the Heiti parent. Distributed to a few durum-wheat growers by the North Dakota Agricultural Experiment Station in the spring of 1950.

VERNUM

Description.—Plant spring habit, early, tall; stem white, midstrong; spike awned, oblong, middense, inclined; glumes glabrous, yellow, midlong, midwide; shoulders narrow to wanting; beaks midwide, acute, 1 mm. long; awns white, 12 to 18 cm. long; kernels white (amber), midlong, hard, elliptical; germ midsized to large; crease wide, middeep; cheeks angular; brush small, short.

Vernum is about 2 or 3 days earlier and has shorter, slightly weaker straw than Mindum. It is resistant to leaf

rust and to stem rust except race 15B, which became prevalent in 1950. Its quality is satisfactory for the making of macaroni.

History.—Vernum (C. I. 12255) was developed in a backcrossing program involving Mindum durum and the rust-resistant Vernal emmer at the North Dakota Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases. It is the result of backcrossing early stem-rust-resistant selections four times to Mindum to recover the grain quality of Mindum. It was designated as Mindum ^{5} × Vernal, Ld. 153, during the testing period and was named Vernum and distributed from the Edgeley Substation in 1947 for growing in the southern part of the region where durum wheat is grown.

Distribution.—Estimated area in 1949, 13,392 acres, grown in North Dakota, South Dakota, and Minnesota.

STEWART

Description.—Plant spring habit, late, tall; stem white, midstrong; spike awned, oblong to fusiform, middense, inclined; glumes glabrous, yellow, long, midwide; shoulders narrow to wanting, rounded; beaks wide, acute, 1 mm. long; awns white, 10 to 18 cm. long; kernels white (amber), midlong, hard, elliptical; germ midsized; crease midwide, middeep; cheeks angular; brush small, short. (See fig. 105, *B.*)

Stewart is resistant to stem rust except race 15B, which became prevalent in 1950. It is resistant to leaf rust and has some resistance to bunt. It is similar to Mindum in strength of straw and like Mindum has excellent macaroni quality. It is about 1 day later than Mindum and more resistant to shattering. Its awns are easily broken off at maturity, giving the spikes an irregular appearance.

History.—Stewart (C. I. 12066) (reg. 334) resulted from the same backcrossing program as Carleton but from a reciprocal cross. The original cross between Mindum and Vernal emmer was made in 1930. A selected F_4 progeny was backcrossed to Mindum in 1933, from which an F_4 progeny was again backcrossed to Mindum in 1936. An F_4 selection of this second backcross, or Mindum ^{3} × Vernal, grown in 1938, was tested as Ld. 111 and later increased and named Stewart. It was developed at the Langdon Substation of the North Dakota Agricultural Experiment Station in cooperative experiments with the Division of Cereal Crops and Diseases and was distributed in 1943 (*191*).

Distribution.—Estimated area in 1949, 1,344,158 acres (fig. 107).

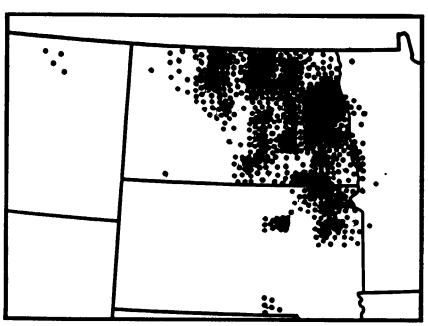

FIGURE 107.—Distribution of Stewart wheat in 1949. Estimated area, 1,344,158 acres.

CARLETON

Description.—Plant spring habit, late, tall; stem white, strong; spike awned, oblong, dense, erect; glumes glabrous, yellow, long, midwide; shoulders narrow to wanting, rounded; beaks wide, acute, 1 mm. long; awns white, 10 to 18 cm. long; kernels white (amber), midlong, hard, elliptical; germ midsized to large; crease midwide, middeep; cheeks angular; brush small, short.

Carleton is resistant to stem rust (except race 15B, which became prevalent in 1950) and to many races of leaf rust. It has stiff coarse straw, erect heads, and is 1 or 2 days later in maturity than Mindum. It has excellent macaroni quality, and the kernels are shorter than those of Mindum. Its awns break off easily at maturity, causing the spikes to have an irregular appearance.

History.—Carleton (C. I. 12064) (reg. 333) resulted from a cross between Vernal emmer and Mindum durum backcrossed twice to Mindum. The cross

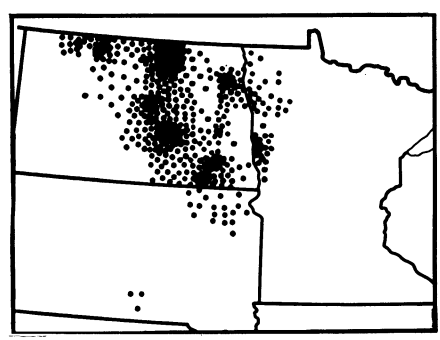

FIGURE 108.—Distribution of Carleton wheat in 1949. Estimated area, 563,762 acres.

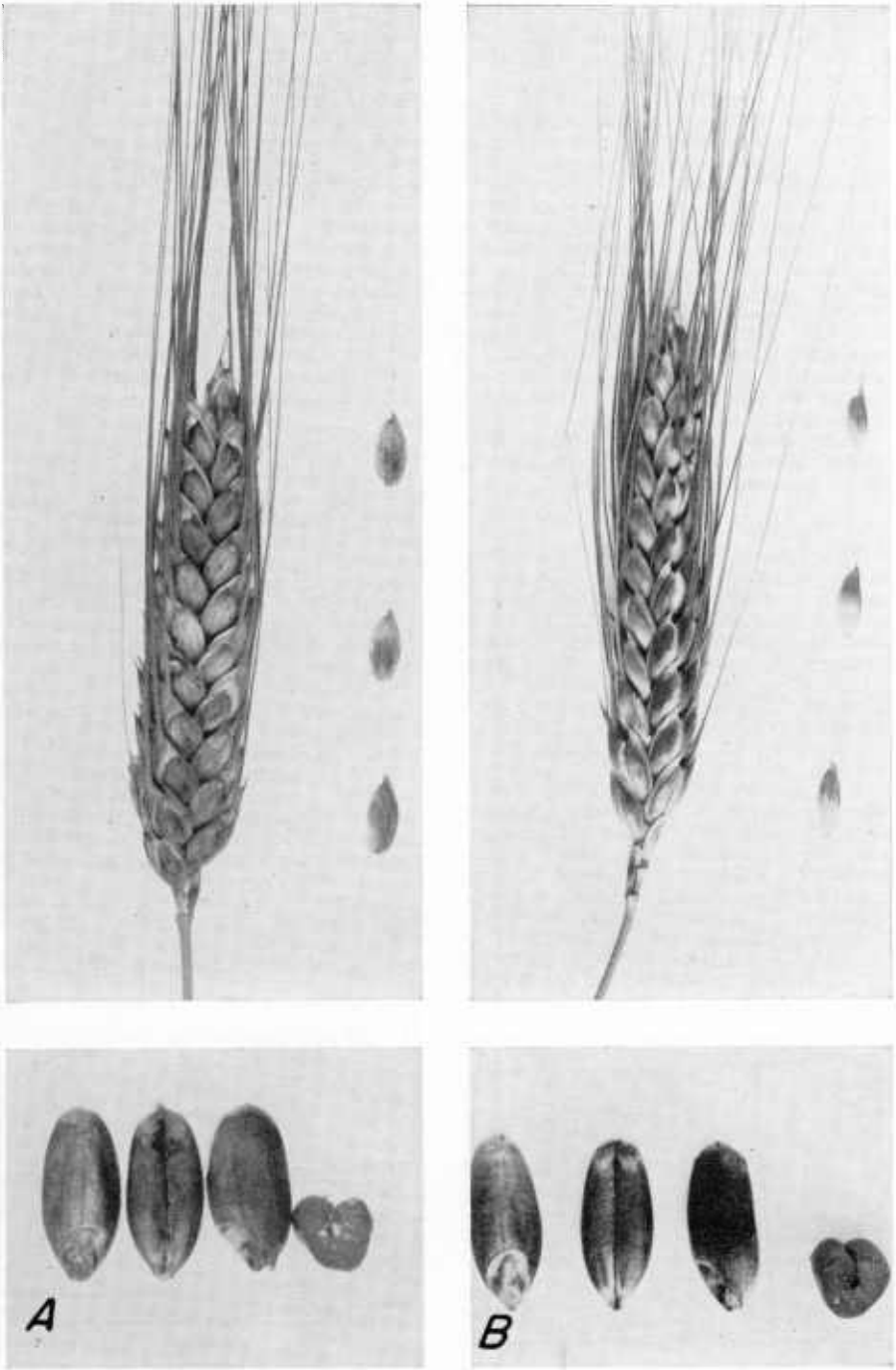

FIGURE 109.—*A*, Kubanka and *B*, Mindum wheats: Spikes and glumes, × 1; kernels, × 3.

Vernal × Mindum was made in 1930. A selected F_3 progeny was backcrossed to Mindum in 1932, from which an F_4 progeny was again backcrossed to Mindum in 1936. An F_4 progeny of this second backcross or Vernal × Mindum [3] grown in 1938 was increased as Ld. 104 and later named Carleton. It was developed at the North Dakota Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases and distributed in 1943 (*191*).

Distribution.—Estimated area in 1949, 563,762 acres, grown in North Dakota, Minnesota, and South Dakota (fig. 108).

KUBANKA

Description.—Plant spring habit, midseason, tall; stem white, midstrong; spike awned, broadly oblong, very dense, inclined to nodding; glumes glabrous, yellowish, midlong, wide; shoulders midwide, usually rounded; beaks wide, 1 to 2 mm. long; awns white, 6 to 15 cm. long; kernels white (amber), midlong, hard, elliptical; germ midsized; crease midwide, shallow; cheeks angular; brush midsized, short. (See fig. 109, *A*.)

Kubanka is more resistant to stem rust than is Arnautka. It differs from Arnautka in having shorter, denser, and more erect spikes and shorter beaks and kernels. It also has better quality than Arnautka.

History.—Kubanka (C. I. 1440) (reg. 215) is of Russian origin. More than a dozen importations into the United States have been made. The principal introduction of the variety was made in 1900 by M. A. Carleton, of the United States Department of Agriculture, from Uralsk Territory, Russia (*211*, P. I. 5639). The original seed of this introduction was grown under contract in New Mexico and South Dakota in 1901, and the following year 200 bushels of seed were distributed to many growers. The distribution was continued by the Department up to 1909. Aside from the distribution made by the United States Department of Agriculture, both the North Dakota and South Dakota Experiment Stations distributed large quantities to growers.

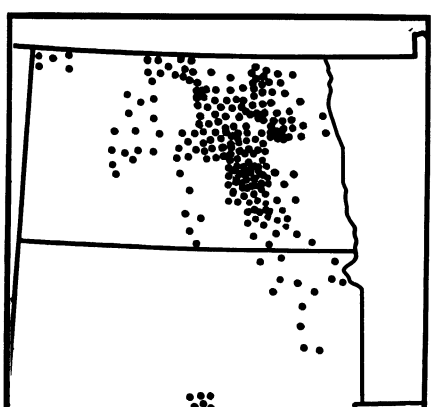

FIGURE 110.—Distribution of Kubanka wheat in 1949. Estimated area, 280,438 acres.

Distribution.—Estimated area in 1949, 280,438 acres (fig. 110). Much of the acreage reported only as durum also is Kubanka.

Synonyms.—Beloturka, Gharnovka, Pererodka, Taganrog, Yellow Gharnovka.

ARNAUTKA

Description.—Plant spring habit, midseason to late, tall; stem white, midstrong; spike awned, oblong to fusiform, middense, nodding; glumes glabrous, yellowish, midlong, midwide; shoulders narrow, usually oblique; beaks wide, 1 to 5 mm. long; awns white, 6 to 18 cm. long; kernels white (amber), midlong, hard, elliptical; germ midsized; crease midwide, shallow; cheeks angular; brush midsized, short.

Arnautka differs from Kubanka in having a longer, narrower, and laxer spike, which usually is more nodding when ripe.

History.—Arnautka (C. I. 1494) (reg. 213) was first introduced by the United States Department of Agriculture in 1864 (*167, p. 27*). It was grown in 1865 with other varieties of wheat on what are now the grounds of the Department of Agriculture, near Fourteenth Street, Washington, D. C. (*17, p. 3*). It was distributed to several sections of the United States, but as far as known never became commercially established. The basis for the present commercial stock is thought to have been brought by early immigrants from Russia to North Dakota (*35, p. 40*), where it was called Wild Goose. Distribution from this source by the Department of Agriculture dates from 1900, when seed (C. I. 1494) was obtained from T. N. Oium, of Lisbon, N. Dak. This seed was distributed with that of Kubanka and other varieties. The variety had previously become established, however, in southeastern North Dakota, where it early proved to be well adapted. A more complete history is given in Technical Bulletin 459 (*43*).

Distribution.—Estimated area in 1949, 4,046 acres, grown in North Dakota.

Synonyms.—Goose, Johnson, Nicaragua, Pierson, Wild Goose.

MINDUM

Description.—Mindum is similar to Arnautka, except for being slightly earlier, in having slightly weaker straw, narrower glumes, longer awns, and a shorter or nearly absent brush, and in being slightly more resistant to stem rust. (See fig. 109, *B*.)

History.—Mindum (C. I. 5296) (reg. 214) was first grown in 1896 in a nursery at University Farm, St. Paul, Minn., as a head selection from a field of common wheat called Hedgerow. It proved to be a rust-resistant strain of durum wheat and was distributed to farmers in 1917 and named Mindum in 1918 (*97, p. 33*).

Distribution.—Estimated area in 1949, 980,677 acres, grown in four States (fig. 111).

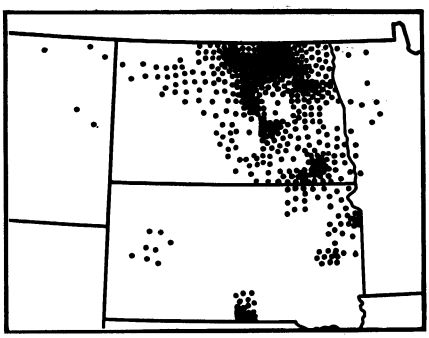

FIGURE 111.—Distribution of Mindum wheat in 1949. Estimated area, 980,677 acres.

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INDEX TO VARIETIES AND SYNONYMS

Recognized varieties are in capitals; varietal synonyms are in capitals and lower case, and common names of species are in italic capitals. Of the two page references given for recognized varieties, the first refers to the key and the second to the description, history, distribution, and synonymy. Each page reference given for a synonym is to the recognized variety for which the name is a synonym. Where two or more page numbers are given, therefore, the name is a synonym of more than one variety.

U. S. GOVERNMENT PRINTING OFFICE: 1954