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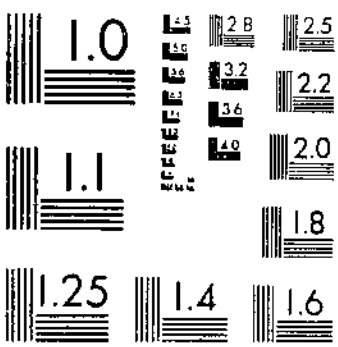
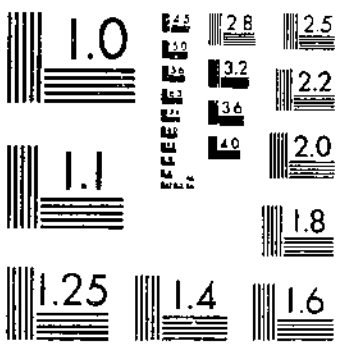


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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MILLING AND BAKING QUALITIES OF WORLD WHEATS

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INTRODUCTION

World production of wheat, excluding that produced in Russia and China, in 1928 was nearly 3,900,000,000 bushels, according to the statistics compiled by the United States Department of Agriculture, which are given in Table 1. Grown as it is under a wide range of

[1] For supplying samples of export material, thanks are extended to the Office of Foreign Plant Introduction of the Bureau of Plant Industry, to the Superintendence Co., and to certain foreign agriculturists. To Ray Weaver, principal scientific aid, Bureau of Agricultural Economics, credit is given for baking a number of the samples.

soil, climatic, and topographical conditions, this wheat necessarily varies considerably in its adaptability to milling and baking purposes. Earlier attempts to classify the milling and baking qualities of wheat grown throughout the world have not been successful because such data as are available have been obtained in many different laboratories which use widely different methods of analysis.

In recognition of the need for information relative to the milling and baking properties of the wheat grown throughout the world as essential to economical marketing and utilization of the world's wheat crop, plans were made by the United States Department of Agriculture, through the grain division of the Bureau of Agricultural Economics, to obtain such information.

Requests were made of every wheat-producing country for samples of wheat to be milled and baked into bread by a standardized milling and baking procedure. As a result of these requests, wheat was obtained from 38 countries distributed through the two hemispheres.

TABLE 1.—*Wheat: Acreage, yield per acre, and production in specified countries, average 1909–1913, 1921–1925, annual 1926–1928*

Country	Acreage					Yield per acre					Production				
	Average 1909–1913 [1]	Average 1921–1925	1926	1927	1928, preliminary	Average 1909–1913 [1]	Average 1921–1925	1926	1927	1928, preliminary	Average 1909–1913 [1]	Average 1921–1925	1926	1927	1928, preliminary
NORTHERN HEMISPHERE															
NORTH AMERICA	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Canada	9,945	22,083	22,896	22,460	24,119	19.8	16.6	17.8	21.4	22.1	197,119	366,483	407,136	479,665	533,572
United States	47,097	58,092	56,337	58,784	57,768	14.7	13.9	14.8	14.9	15.6	690,108	804,151	831,040	878,374	902,191
Mexico	[2] 2,174	2,098	1,286	1,311	1,283	5.3	5.0	8.0	9.1	8.6	[3] 11,481	10,388	10,333	11,890	11,031
Guatemala		24	25	23			9.2	8.0	9.6			222	200	220	
Total countries reporting all years	59,216	82,273	80,519	82,555	83,170	15.2	14.4	15.5	16.6	17.4	898,708	1,181,022	1,248,509	1,369,929	1,446,794
EUROPE															
United Kingdom:															
England and Wales	1,787	1,746	1,592	1,636	1,596	31.2	32.9	30.6	32.5	33.9	55,770	57,524	48,683	53,125	47,264
Scotland	57	57	54	67	58	39.9	39.5	38.7	36.2	39.9	2,273	2,251	2,091	2,427	2,315
Northern Ireland	8	4	6	6	5	35.9	27.8	37.7	35.3	36.6	287	111	226	212	183
Irish Free State	35	34	29	34	31	37.4	33.3	39.8	41.8	38.3	1,310	1,131	1,155	1,421	1,186
Norway	12	27	22	25	25	25.5	23.6	26.6	24.2	27.0	306	637	586	605	676
Sweden	255	352	381	574	574	31.8	30.1	31.9	28.1	33.9	8,103	10,602	12,153	16,151	19,469
Denmark	154	202	252	274	252	41.1	44.4	34.8	34.3	48.5	6,322	8,973	8,767	9,408	12,214
Netherlands	138	147	132	153	148	36.1	42.5	41.6	40.2	49.6	4,976	6,243	5,487	6,157	7,336
Belgium	404	339	354	391	425	37.6	38.9	36.2	41.6	42.3	15,199	13,194	12,801	16,277	17,986
Luxemburg	27	23	32	36	37	22.8	17.0	19.4	19.5	21.6	615	392	622	702	799
France	16,500	13,507	12,971	13,065	12,956	19.7	21.5	17.9	21.1	21.7	325,644	290,875	231,767	276,128	281,285
Spain	9,547	10,457	10,775	10,826	10,571	13.7	13.6	13.6	13.4	11.6	130,446	142,420	146,599	144,825	122,640
Portugal	[4] 1,211	1,078	1,063	1,082		[4] 9.8	9.9	8.1	10.6		[4] 11,850	10,626	8,560	11,447	6,578
Italy	11,793	11,537	12,145	12,295	12,264	15.6	17.2	18.2	15.9	18.6	184,393	198,307	220,644	195,809	228,596
Switzerland	105	110	127	127	127	31.6	30.1	33.4	32.4	33.6	3,314	3,314	4,244	4,119	4,270
Germany	4,029	3,613	3,957	4,321	4,269	32.6	27.3	24.1	27.9	33.2	131,274	98,714	95,429	120,522	141,593
Austria	635	456	500	505	505	20.2	18.4	18.9	23.7	25.5	12,813	8,400	9,438	11,960	12,860
Czechoslovakia	1,718	1,523	1,552	1,579	1,871	22.0	23.6	22.0	25.6	27.5	37,879	36,015	34,130	40,385	51,499
Hungary	3,712	3,345	3,706	4,021	4,144	19.3	17.8	20.2	19.1	23.9	71,493	59,678	74,909	76,933	99,211
Yugoslavia	3,982	3,953	4,178	4,521	4,599	15.6	14.9	17.1	12.5	22.5	62,024	58,753	71,427	56,568	103,294
Greece	[5] 1,134	1,075	1,304	1,233	1,313	[4] 14.4	8.8	9.5	10.5	11.9	[4] 16,273	9,417	12,403	12,970	15,676
Bulgaria	2,409	2,390	2,617	2,673	2,779	15.7	13.1	14.0	15.8	18.2	37,823	31,399	36,544	42,121	50,691
Rumania	[3] 9,515	7,068	8,222	7,663	7,923	[3] 16.7	12.7	13.5	12.6	14.6	[3] 158,672	89,570	110,883	96,734	115,544

[1] Where changes in boundaries have occurred averages are estimated for territories within the present boundaries. [2] 2-year average. [3] 4-year average. [4] 1 year only.

TABLE 1.—*Wheat: Acreage, yield per acre, and production in specified countries, average 1909–1913, 1921–1925, annual 1926–1928*—Con.

Country	Acreage					Yield per acre					Production				
	Average 1909–1913	Average 1921–1925	1926	1927	1928, preliminary	Average 1909–1913	Average 1921–1925	1926	1927	1928 preliminary	Average 1909–1913	Average 1921–1925	1926	1927	1928, preliminary
NORTHERN HEMISPHERE—Con.															
EUROPE—Continued	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Poland	3,350	2,957	3,246	3,360	3,187	19.0	16.5	16.2	18.2	18.6	63,675	48,708	52,490	61,093	59,219
Lithuania	211	214	303	297	393	15.5	16.6	13.8	17.8	16.1	3,264	3,563	4,180	5,273	6,327
Latvia	85	89	122	145	164	17.4	16.0	15.2	18.2	15.2	1,475	1,426	1,860	2,636	2,499
Estonia	23	47	59	67	70	15.8	14.2	14.3	16.1	14.8	364	667	844	1,079	1,037
Finland	8	36	39	44	42	17.1	20.5	23.7	24.2	20.9	137	739	924	1,064	879
Russia	74,209	39,066	70,882	75,941	68,044	10.2	10.1	11.6	9.8	12.6	758,941	394,393	819,744	745,885	859,789
Total countries, exclusive of Russia, reporting all years	71,633	65,308	68,677	69,938	70,128	18.7	18.1	17.5	18.0	20.1	1,336,124	1,183,023	1,201,236	1,256,704	1,406,548
Estimated European total, excluding Russia	72,800	65,900	69,290	70,500	71,100	-------	-------	-------	-------	-------	1,348,000	1,192,000	1,205,000	1,262,000	1,413,000
AFRICA															
Morocco	(1,700)	2,272	2,558	2,304	2,665	-------	9.6	6.3	10.7	9.3	(17,000)	21,758	16,174	24,618	24,746
Algeria	3,521	3,416	3,741	3,469	3,656	10.0	7.8	6.3	8.2	8.3	35,161	26,647	23,551	28,323	30,302
Tunis	1,310	1,402	1,840	1,408	2,011	4.8	5.6	7.1	5.9	6.0	6,224	7,892	13,044	8,267	12,125
Egypt	1,314	1,462	1,532	1,655	1,590	25.6	25.2	24.3	26.8	23.5	33,662	36,806	37,207	44,347	37,296
Total	7,845	8,552	9,671	8,836	9,922	11.7	10.9	9.3	11.9	10.5	92,047	93,103	89,976	105,555	104,469
ASIA															
Cyprus	162	191	191	171	-------	13.7	12.0	9.5	14.0	-------	2,216	2,292	1,819	2,390	----------
India	29,224	29,560	30,471	31,303	32,216	12.0	11.4	10.7	10.7	9.0	351,841	336,269	324,651	334,992	288,811
Japanese Empire:															
Japan	1,179	1,197	1,146	1,161	1,201	21.3	23.9	26.3	26.7	25.7	25,088	28,553	30,188	31,018	30,812
Chosen	574	882	895	897	893	12.0	11.6	11.8	10.1	9.6	6,898	10,208	10,517	9,043	8,595
Formosa	15	7	1	1	-------	11.3	9.1	13.0	14.0	-------	169	64	13	14	----------
Kwantung	[5] 4	4	4	4	-------	10.0	11.8	8.5	9.8	-------	[5] 40	47	34	39	----------
Total Asiatic countries reporting all years	30,977	31,639	32,512	33,361	34,313	12.4	11.9	11.2	11.2	9.6	383,827	375,030	365,356	375,053	328,218

Estimated Asiatic total excluding Russia and China	37,600	37,900	37,700	40,300	39,000						419,000	447,000	434,000	455,000	369,000
Total Northern Hemisphere countries excluding Russia reporting all years	169,671	187,772	191,379	194,690	197,533	16.0	15.1	15.2	16.0	16.6	2,710,706	2,832,178	2,905,127	3,107,241	3,286,029
Estimated Northern Hemisphere total excluding Russia and China	177,500	195,000	197,300	202,400	202,800						2,759,000	2,914,000	2,979,000	3,193,000	3,333,000
SOUTHERN HEMISPHERE															
Brazil		[3] 224	240	330			21.9	20.7	12.7			4,968	4,960	4,203	
Chile	1,003	1,443	1,462	1,530	1,975	20.9	17.9	15.9	18.5		20,062	25,761	23,286	28,307	
Uruguay	[3] 791	867	988	1,151	1,256	[3] 8.2	11.2	10.4	13.4	11.7	[3] 6,517	9,680	10,238	15,397	14,672
Argentina	16,051	16,935	19,274	19,714	20,899	9.2	12.0	11.5	12.1	14.7	147,059	203,388	220,827	239,162	307,360
Union of South Africa	[4] 803	868	881	912	985	[4] 7.5	8.6	9.1	7.3	7.0	[4] 6,034	7,459	8,043	6,644	6,930
Southern Rhodesia		[5] 4	5				[5] 7.4	7.8				31	39		
Australia	7,603	10,010	11,688	12,264	14,590	11.9	12.8	13.8	9.5	10.9	90,497	128,520	160,762	116,737	159,000
New Zealand	241	224	222	262	255	28.7	29.6	35.8	36.4	34.6	6,925	6,640	7,952	9,541	8,819
Total Southern Hemisphere countries reporting all years	25,489	28,904	33,053	34,303	37,985	10.1	12.3	12.3	11.3	13.1	257,032	355,687	407,822	387,481	496,781
Estimated Southern Hemisphere total	26,700	31,000	35,200	36,800	40,200						282,000	391,000	441,000	460,000	532,000
Total Northern and Southern Hemisphere countries excluding Russia, reporting all years	195,160	216,676	224,432	228,993	235,518	15.2	14.7	14.8	15.3	16.1	2,967,738	3,187,865	3,312,949	3,494,722	3,782,810
Estimated world total excluding Russia and China	204,200	226,000	232,500	239,200	243,000						3,041,000	3,305,000	3,420,000	3,653,000	3,865,000

Bureau of Agricultural Economics. Official sources and International Institute of Agriculture. Figures in parenthesis indicate unofficial estimates. For each year is shown the harvest during the calendar year in the Northern Hemisphere and the succeeding harvest in the Southern Hemisphere.

[3] 4-year average. [4] 1-year only. [5] 3-year average.

SOURCE OF SAMPLES

The wheats tested were of two types—wheat varieties and export wheats. The samples of wheat varieties were obtained from agricultural officials, and private breeders located in the various countries. These varieties were secured through the assistance of John H. Stevenson of the Office of Foreign Plant Introduction, Bureau of Plant Industry, grateful acknowledgment of whose assistance is hereby made. In asking for these wheat varieties it was requested that only varieties or types of wheat that are of commercial importance, in each country, be sent.

The samples of export wheats were obtained through the assistance of the Superintendence Co., of New York, at various foreign seaports from cargo shipments of wheat at the time the wheat was unloaded.

A similar series of samples of United States export wheat was secured through the cooperation of the several Federal grain supervisors located at United States shipping points.

The total number of samples tested in this study was 852. Of these, 421 were varietal samples and 431 were samples of export wheat. Data showing the number and kind of samples obtained from each country are given in Table 2, which also gives a list of the countries that contributed samples of wheat for this study and the number and kind of samples sent. Most of the wheats were grown during the crop year 1926, but some were grown in 1927.

TABLE 2.—*Number, kind, and source of samples of wheat received*

Country	Varietal samples—							Export samples in which the class predominating was—						Grand total
	Hard red spring	Durum	Hard red winter	Soft red winter	White	Poulard	Total	Hard red spring	Durum	Hard red winter	Soft red winter	White	Total	
North America:	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Canada	4	2	1		3		10	140	2			2	144	154
Mexico				7	15		22						0	22
United States	14	5	15	9	11		54	15	11	67	63	46	202	256
South America:														
Argentina		1	7	4	1		13	3		56			59	72
Chile					4		4				1	1	2	6
Uruguay	4	3					7			1			1	8
Europe:														
Belgium				3	3		6						0	6
Bulgaria	1	2	1	3	1		8						0	8
Czechoslavakia	1		1				2						0	2
Denmark				2	1		3						0	3
England	3			12	3		18						0	18
Estonia	3				1		4						0	4
Germany	2			4		1	7				6		6	13
Greece		3			1		4						0	4
Hungary	1		1	2			4						0	4
Ireland				6	1		7						0	7
Italy		3		23	3	3	32						0	32
Latvia	2	1		2			5						0	5
Lithuania				2	2		4						0	4
Netherlands	1			1	5		7						0	7
Norway	5						5						0	5
Poland	1				1	1	4						0	4
Portugal		1		1		1	3						0	3
Russia	5	13	11	9	2		40						0	40
Scotland				4	2		6						0	6
Spain		1		2	2		5						0	5
Sweden	3			3	1		7	1			1		2	9
Switzerland	1			8			9						0	9
Africa:														
Egypt					4	5	9						0	9
Morocco		1			1		2						0	2
Tunis		3			5		8						0	8
Union of South Africa	5			3	5		13						0	13
Asia:														
India	1	2	1	4	21	1	30			1		2	3	33
Iraq		3			6		9						0	9
Japan	4			3	2	1	10						0	10
Palestine		2				1	3						0	3

TABLE 2.—*Number, kind, and source of samples of wheat received*—Continued

Country	Varietal samples—							Export samples in which the class predominating was—						Grand total
	Hard red spring	Durum	Hard red winter	Soft red winter	White	Poulard	Total	Hard red spring	Durum	Hard red winter	Soft red winter	White	Total	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Oceania:														
Australia	2	1	1	2	27		33					12	12	45
New Zealand					4		4						0	4
Total	63	48	39	119	138	14	421	159	13	125	71	63	431	852

[1] Spelt.

[2] Includes sample of Polish wheat (Triticum polonicum L.).

It is to be regretted that Algeria, China, France, and Yugoslavia did not forward samples of the various varieties of wheats produced in their respective countries for inclusion in this study.

Because of changes in environmental conditions that control the production of wheat from year to year, observations based on analyses of samples of one year's crop should not be considered as final. But the baking properties of the wheats produced in the majority of the countries were so widely different, according to this study, that the differences can scarcely be attributable, in any significant degree, to annual variation in the sample characteristics. Moreover, with but one or two exceptions the statement accompanying the samples was to the effect that the wheat they represented was grown in an average crop year. Considering these facts, and the difficulties encountered in obtaining the samples for testing, a continuation of the study was deemed inadvisable.

FACTORS DETERMINING THE MILLING AND BAKING QUALITY OF WHEAT

Quality in wheat is an expression which conveys different ideas to the minds of producers, millers, and bakers. To the wheat producer, generally speaking, quality in wheat means high yields per acre of sound, plump wheat of high test weight. Supplementary to this definition, the protein content of the wheat is assuming importance in some quarters.

For the miller, this definition does not go far enough. To his mind, quality wheat in addition to being plump and of high test weight per bushel, should likewise be of good color, should be reasonably free from foreign material, should be practically free from damaged kernels of every description, should have characteristics of easy milling, and should be free from admixtures of wheats of other commercial classes.

The miller wants wheat that is plump and of high test weight because the test weight per bushel is related to the flour-yielding capacity of the wheat; the plumper the wheat the greater is the percentage of endosperm (floury portion), and the less is the percentage of seed coats or bran. Good color is evidence that the wheat has not been exposed to conditions that would damage the grain. Among the hard wheats, kernel texture is important, since, other factors being equal, there is a close relation between the percentage of dark, hard, and vitreous kernels and baking quality (*8*).[2]

Foreign material in wheat is of various kinds and has various effects upon the milling value of wheat. Some types of foreign material can be easily removed by machinery, whereas others, because of similarity to the size, shape, and specific gravity of the wheat kernel, are very difficult to remove, and in some cases it is even impossible to remove them by mechanical means. Foreign materials that can be removed in the ordinary process of preparing wheat for milling have no effect on the milling of wheat, except when they impart an objectionable odor to the wheat, such as the seed of sweetclover. But they play an important part from an intrinsic-value standpoint, inasmuch as such foreign material does not, as a rule, produce flour. Foreign material of the inseparable types greatly influence the milling value of wheat, as has been shown by Miller (*6*).

[2] Italic numbers in parentheses refer to Literature Cited, p. 223.

Damaged wheat of any type is objectionable to the miller. Modern milling is possible because the bran coat, the germ, and the endosperm of wheat differ in relative toughness or friability. When wheat is damaged in any way, especially by heat of fermentation or by early frosts, the toughness of the bran coat is lessened, and milling difficulties ensue. Then, too, the bread-making qualities of such damaged wheat are injured, as has been shown by Coleman and Rothgeb (*3*) in the instance of heat-damaged wheat, and by Johnson and Whitcomb (*4*) in their work on frosted wheats.

Mixtures of various classes of wheats are not liked by the miller because the classes of wheat do not all mill alike, and the presence of one class in a lot of another class interferes with the efficient milling of any given class.

After the wheat has been milled certain information in addition to the yields of flour and of offal are important to the miller in helping him to decide as to the merits of the wheat in question. These are the color and texture of the flour, and its ash and protein content.

From the color standpoint, the whiter the flour the more desirable it is for the manufacture of bread, biscuits, or cakes. For certain purposes, as for making macaroni and alimentary pastes, a creamy product is more desirable. The protein content is intimately associated with the baking quality of the flour and the ash content indicates something regarding the grade of flour as well as the adaptability of the wheat in question to the miller's needs.

For the baker there is no set standard of quality, inasmuch as there is no universally standardized method for making bread. Nor are there any uniform standards for the finished product. Baking characteristics differ in degree of importance, as viewed by different people, depending upon the kind and quality of the product desired.

Under such conditions it is well for the baker to have access to detailed observations with respect to each of the various factors that are generally recognized as indicative of quality so that he can select flour on the basis of his own requirements.

The baking characteristics of most importance to the baker include the following: Length of time for fermentation and for proofing; water absorption of the flour; volume, weight, and break and shred of the loaf; color, grain, and texture of the crumb; and color of the crust.

The length of time that dough can be allowed to ferment and proof before deterioration of the gluten begins, is highly indicative of the strength of the gluten. The longer the dough will ferment or proof before the gluten begins to deteriorate, the greater is the fermentation tolerance or the margin of safety, and the more neglect or punishment will the gluten stand before unsatisfactory results follow. Commercial bakers who use machine methods for baking give considerable importance to this factor.

When the dough is allowed to ferment to the point at which the loaf of greatest size possible to that dough is produced, the loaf volume (in tests in which uniform quantities of flour, yeast, salt, and sugar are used) may be considered an expression of the relative strength of flour whether in commercial or household baking.

The water-absorbing capacity of a flour is of some importance inasmuch as it is related in a measure to the quantity and quality of the gluten in the flour. Other things being equal, a flour with a high

gluten content will absorb more water than one with a low gluten content. There are frequent exceptions, however, because of the quality factor ever present in gluten. In other words, a flour containing a high percentage of gluten of low quality will absorb less water than a flour containing a lower percentage of gluten of high quality. Water absorption is likewise related to the weight of the loaf as a flour containing gluten of good quality will absorb and hold the added water against the heat of the baking oven.

Clearness, brightness, and whiteness of flour are the requisites for high color scores.

Grain of crumb indicates the size and regularity of the cells or holes in the crumb and the thickness of the cell walls. Small cells or holes, uniform in size, slightly elongated, and with thin walls, are considered the most desirable.

Texture of crumb refers to the smoothness, softness, and resiliency as determined by the sense of touch.

When baked under uniform and controlled conditions, weight of loaf is of value in calculating the number of loaves of unit weight that can be produced from a given quantity of flour.

"Break and shred" is a term synonymous with oven spring. The heat of the bake oven causes an expansion of the dough. This expansion is accompanied by a stretching of the fibers on the outer surface of the loaf—usually on one side of the loaf only. The resulting appearance of the loaf at the point at which this occurs is referred to as break and shred. If the fibers stretch uniformly without breaking and with a shredded or comblike appearance, the break and shred is considered good. When the length of time the dough is allowed to ferment does not extend beyond the point at which the gluten begins to deteriorate, the character of the break and shred of the baked loaf is a further indication of the elasticity of the gluten.

Color of crumb has reference to the top crust of the bread. A dark-brown color of crust is usually considered more desirable than a pale-brown color.

Shade of color of crumb is a description of the inside color appearance of the loaf with respect to the degree of creaminess and to other colors present. It is not so inclusive as the color score of the bread which, in addition to taking into account the various color combinations present, considers them from the standpoint of desirability.

In making the comparative studies reported upon later in this bulletin, the magnitude of the quality factors were recorded and are presented in the appropriate tables.

In addition, a detailed study was made with regard to the component parts of the gluten proteins in the flour to ascertain whether there was sufficient variation in the glutenin-gliadin ratios to account for some of the differences in the baking quality of the several flours.

METHODS OF ANALYSIS USED

The methods of analysis used to determine the various factors relative to milling and baking quality, were as follows:

GRAIN GRADING METHODS

The tests made relative to the quality and condition of the grain with regard to its suitability for milling purposes were those described

in the Handbook of Official Grain Standards (*9*) issued by the United States Department of Agriculture.

CHEMICAL METHODS

The chemical determinations were completed as described in the book of methods of analysis of the American Association of Cereal Chemists (*1*).

MILLING METHODS

Determination of the milling qualities of the different samples of wheat was made with experimental or laboratory equipment rather than with the type of equipment used in commercial establishments. The type of experimental mill used consists of four pairs of 6-inch rolls (three corrugated and one smooth), a sifter, and sieves appropriate for making the various separations of stock required. (Fig. 1.)

FIGURE 1.—Interior of experimental mill

The operation of an experimental mill necessarily differs in some respects from that of a commercial mill. In the experimental mill there is no continuous or automatic flow of stock from one machine to another as in a commercial mill. This is an advantage in that it gives the operator a better opportunity to vary his method of grinding and bolting to suit the character and condition of the individual sample. Furthermore, it decreases the possibility of losing material or of contaminating one sample with another because of the smaller number of places in which material may lodge. Other points of difference are the absence of purifiers and bran and shorts dusters. In spite of these differences, a skillful and experienced operator is able to accomplish results on this mill which compare favorably in quality and efficiency with the work of commercial mills. The various grindings necessary for milling a sample and the size of sieves to be used in the sifter after each grinding are indicated on the flow sheet shown in Figure 2.

To accomplish the five breaks shown on the flow sheet the first stand of rolls, having 16 corrugations per inch, is used for the first and second breaks, the second stand with 20 corrugations per inch is used for the

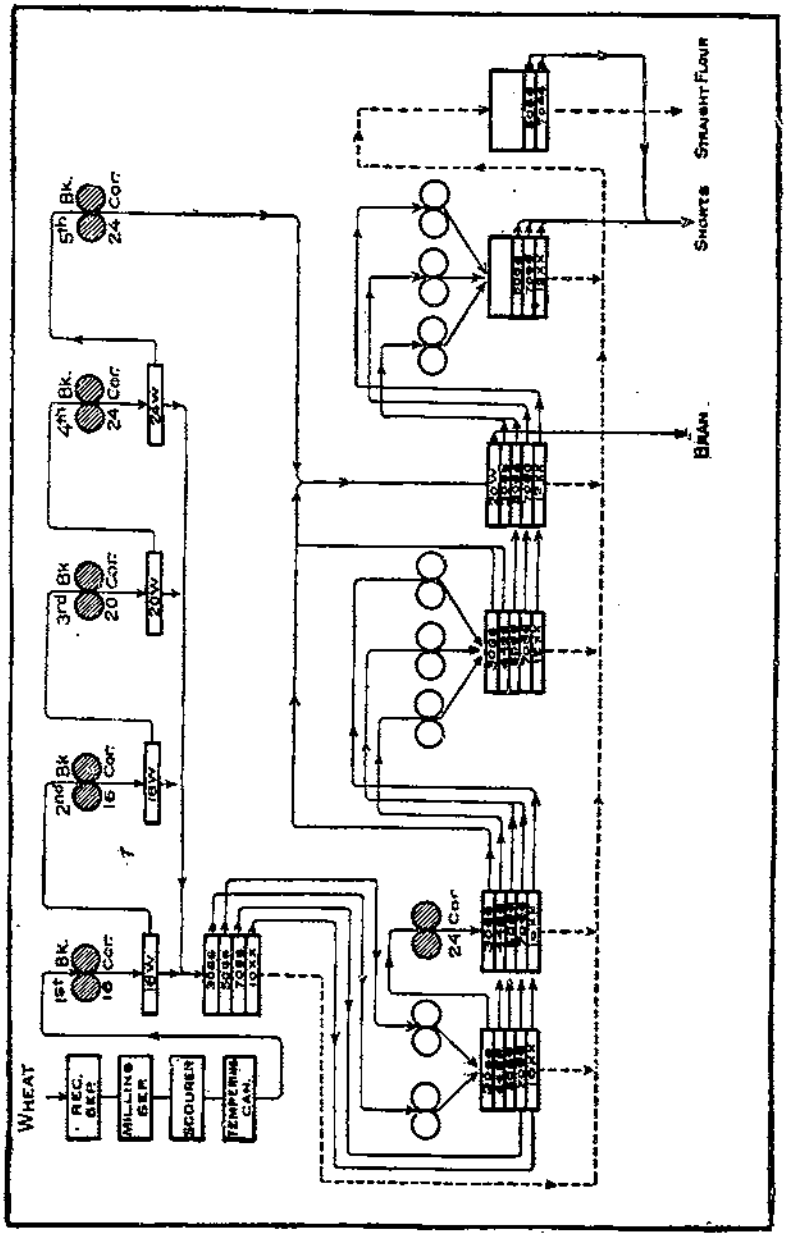

FIGURE 2.—Flow sheet of experimental mill

third break, and the third stand, having 24 corrugations per inch, is used for the fourth and fifth breaks. In those instances in which one stand of rolls is used for two breaks, the rolls are reset when changing

from one break to the other to grind to the fineness desired. The speed differential of the break rolls is 2½ to 1.

The smooth rolls are used for the reduction of middlings and tailings. The reduction of the different grades of middlings stock on these rolls is merely a matter of proper adjustment. The speed differential of the smooth rolls is 1½ to 1.

The sifter is so constructed that five sieves can be used at one time. The sieves used in the sifter in making separations from the first break grinding are, from top to bottom, clothed with No. 16 wire, 30, 50, and 70 grit gauze, and 10 XX silk, respectively. The sieves used for the separation of stock from the second, third, fourth, and fifth breaks

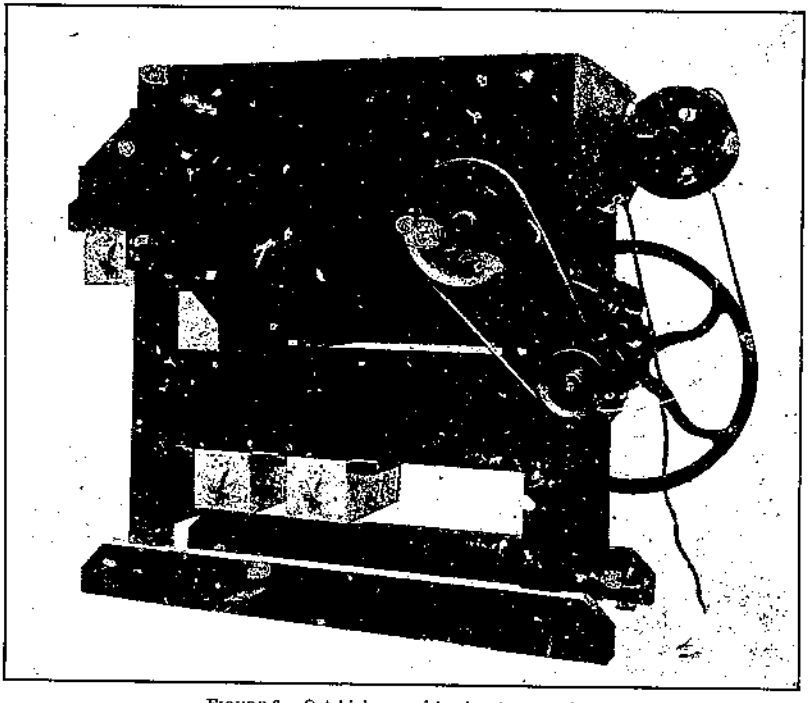

FIGURE 3.—Oat kicker used in cleaning samples

are, with the exception of the top sieve, the same as for the first break. The top sieve used for sifting second break is clothed with No. 18 wire, sieves for third and fifth breaks are clothed with No. 20 wire, and the sieve for the fourth break is clothed with No. 24 wire.

In milling a sample the ground material is transferred by hand from the rolls to the sifter and from the sifter to the rolls. All the separations resulting from each sifting are not removed immediately from the sifter, but some are left to accumulate through the siftings of several different grindings.

Before the actual grinding or milling of the sample begins, certain preparatory operations are necessary. First, the sample to be milled is reduced to the proper size for making the milling tests. For the purpose of these studies the original weight of the sample was 2,200 grams. This weight of grain is run over a small cleaning machine known as an "oat kicker" (fig. 3), and then through a small

milling separator (fig. 4), to remove foreign material. The cleaned grain is weighed, and this weight serves as the basis of determining the percentage of foreign material or screenings removed. The weighed and partially cleaned grain from the milling separator is then put through a small-sized wheat scourer (fig. 5), and the loss in weight is noted. From this loss the scouring loss is determined. By adding together the loss as screenings and the loss due to scouring, the data that are given in the tables on milling quality under the heading "Screenings and scourings removed" were obtained. The test weight per bushel of the wheat, on the basis of the Winchester bushel, is then determined. The sample is then reduced to the exact weight to be used for milling—1,800 grams. At this point the moisture content of the wheat is determined so that this information will be available for the purpose of tempering. The sample is then tempered, a closed container being used for this purpose.

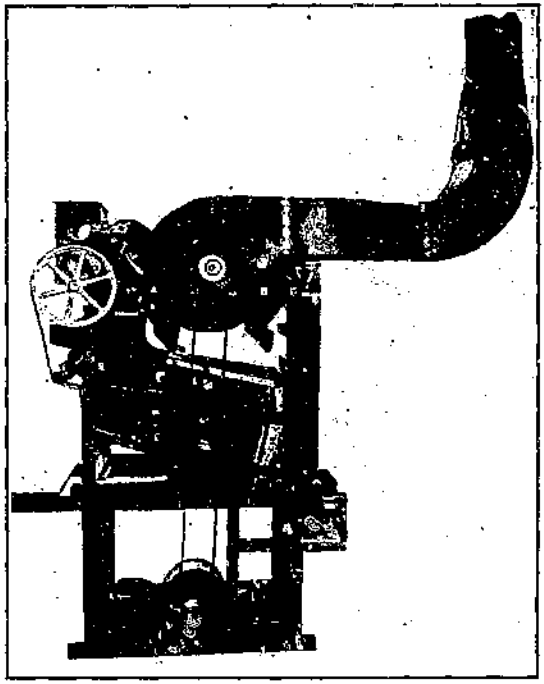

FIGURE 4.—Experimental milling separator used for cleaning samples

The tempering process consists of adding sufficient water to the wheat to raise its moisture content to the percentage desired for the milling test. This is done 18 to 24 hours before the sample is to be milled. The moisture content considered desirable for the experimental milling of the soft red winter and white wheats was 14 per cent. The hard red winter, hard red spring, and durum wheats were tempered to 15 per cent moisture.

The products—bran, shorts, and flour—obtained from the milling of a sample are weighed and the weights recorded. These weights, together with the recorded weight of the wheat used for milling, serve, in conjunction with a knowledge of the moisture content of the wheat and flour, as the means of calculating milling yields.

In these studies the yield is computed on the basis of the moisture content of the wheat at the time of milling. This plan has been adopted for several reasons. The moisture content of freshly milled flour varies considerably. There are a number of causes, principal among which are the original moisture content of the wheat, the conditioning of the wheat for milling purposes, and the temperature and humidity of the atmosphere in the mill at the time the sample is being milled. To compute flour yields on any other moisture basis

than that of the original moisture content of the wheat at the time of milling makes the milling performance of the wheat under test a matter of milling conditions rather than of the sample under test. Bran and shorts may be considered as total feeds, and the percentage present may be considered as the difference between the flour yield and 100, giving due consideration to a small experimental error incident to the milling performance.

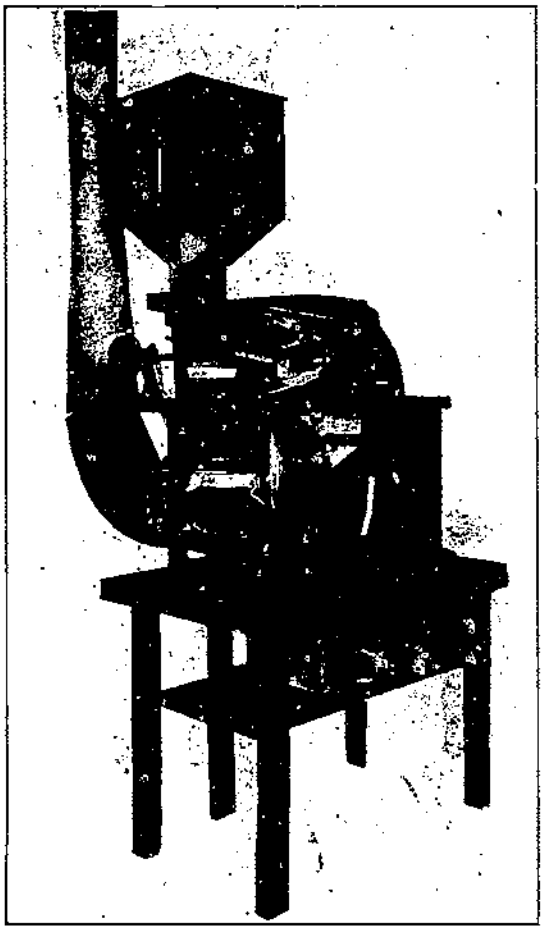

FIGURE 5.—Experimental wheat scourer used in cleaning samples

The flour yields are expressed on two bases: (1) On the basis of the weight of dockage-free wheat; and (2) on the basis of the weight of the cleaned and scoured wheat. From a grading standpoint the first method is the preferred one, although the second procedure is frequently used. Further, to facilitate a decision as to the milling quality of the wheats under test, the weight of the wheat under study that is necessary to produce a barrel of flour (196 pounds) containing 13.5 per cent moisture has been computed.

BAKING METHOD

In testing the baking quality of the experimentally milled flours a straight-dough method was used, mixed according to the following basic formula:

	Grams
Flour	340
Sugar	12
Salt	6
Yeast	10
Shortening	6.8
Water (distilled) sufficient to produce a dough of the proper consistency.	

The samples of flour were aged at least a week. The night before being baked they were put into small tin boxes with covers, in the fermentation cabinet (fig. 6) and kept at 30° C. The earthenware crocks in which the doughs were to be fermented were put in the fermentation cabinet at the same time to insure a uniform tempera-

ture of the flour and the equipment throughout. The relative humidity within the fermentation cabinet was maintained at a high point (at least 85 per cent) by means of shallow pans of water put in the bottom of the cabinet.

Previous to mixing the dough, the salt, sugar, and shortening were weighed out individually for each test. The yeast solution was prepared in bulk in the ratio of 30 cubic centimeters of distilled water to 10 grams of yeast. Care was taken to have the temperature of the yeast suspension 30° C. Experience has shown that 38.5 cubic centimeters of the resulting yeast and water suspension at 30° carry the equivalent of 10 grams of yeast.

The 1-loaf mixing device (fig. 7) was next assembled, warmed to 30° C., and placed in position for operation. One hundred and seventy to one hundred and eighty cubic centimeters of distilled water at 30° (the quantity accurately known) was placed in the bowl of the dough mixer, and the salt, sugar, and shortening added. One-half of the flour was then added, and 38.5 cubic centimeters of the yeast suspension, which has been thoroughly agitated before withdrawal, was pipetted off. The remaining portion of the flour was then added and the mixing operation started. More distilled water was added from a measuring cylinder until the dough reached the proper consistency. The water absorption of the flour was determined by adding together the quantity of water first placed in the mixing bowl, the water added in the yeast suspension, and the water added from the measuring cylinder to bring the dough to the proper consistency, and dividing by the weight of the flour used; that is, 340 grams.

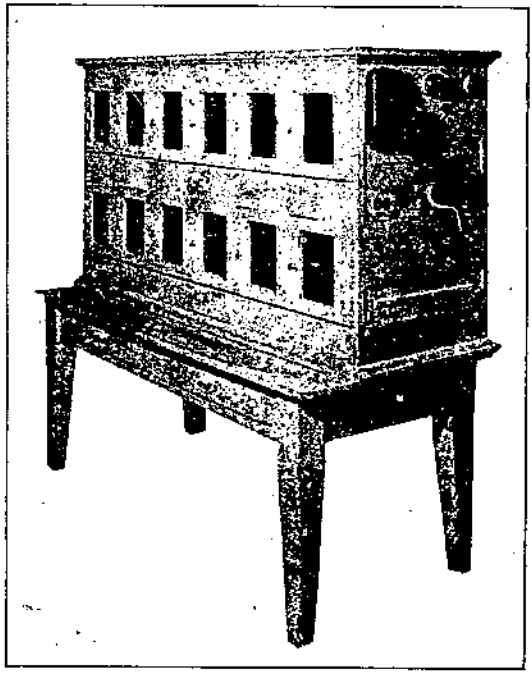

FIGURE 6.—Fermentation cabinet

The dough-mixing time was standard for all samples, namely, five minutes.

The temperature of the dough was maintained at 30° C. during mixing as nearly as possible in order to prevent rise in dough temperature occasioned by the friction of the bearing of the dough mixer and the temperature of the surrounding atmosphere. Temperature control was accomplished by placing the dough mixer in an ice bath and adding cracked ice to the bath from time to time.

After being mixed the dough was removed and placed in one of the previously warmed earthenware crocks. The temperature of the dough was noted. A tin cover was placed over the top of the crock to prevent the dough from crusting, and the crock was then placed in the fermentation cabinet and allowed to ferment. The fermentation time was variable, depending largely upon the inherent quality of the flour. Hard wheat flours received two punches, and then rested 20 minutes before being panned. Soft wheat flours receive but one punch and were allowed to rest for a period equal to one-half of the first punch and are then panned.

While the doughs were fermenting they were closely watched to determine the proper time for the first punch. The experience of the technician, with regard to the feel and action of the dough, suggested the proper time for the first punch. The time of the second punch was determined in accordance with a previously prepared schedule. This schedule had been compiled as the result of extended experience in baking the various classes of flour in question.

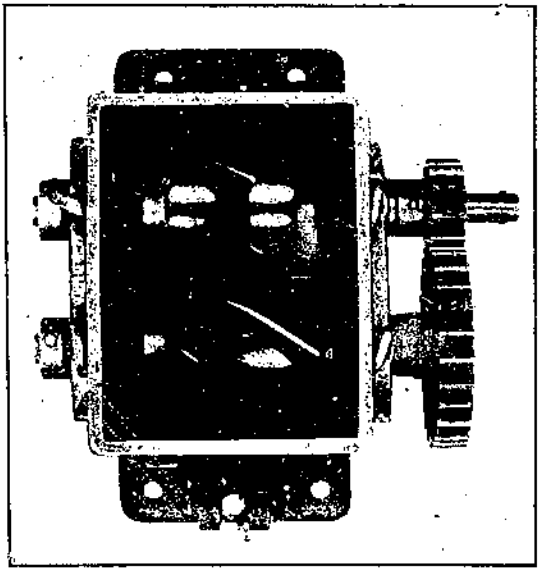

FIGURE 7.—Dough-mixing machine

The dough was punched by being removed from the crock and folded over or rounded up in the hands four or five times; it was then returned to the crock in the cabinet. All doughs received the same degree of rounding up.

At the end of the total fermentation period the doughs were removed from the cabinet and molded on a mechanical 1-man loaf molder. They were then placed in a commercial type of bread pan having the following dimensions: 4½ by 9½ inches at the top, 3½ by 8½ inches at the bottom, and 2¾ inches deep. The pans were placed in the proofing cabinet.

The proofing cabinet was constructed like the fermentation cabinet but had a larger number of pans of water on the bottom shelf to afford more extensive humidity as the doughs were not covered during proofing. The temperature of the proofing cabinet was maintained at 35° C. Proper proofing was determined by the appearance of the dough and its height in the pan. The objective was to catch the dough at a point just under its maximum proof to avoid the danger of overproofing.

The loaves were baked at 225° C. for 30 minutes. They were then removed from the pans and placed upon a wire rack to cool. About

one-half hour after being taken out of the oven the volume and weight of each was recorded. The outside scoring of the loaf was made the day it was baked. The inside scoring was made on the following day. The loaves were cut in half and scored for the factors of quality previously discussed. Numerical scores were given to color and grain after comparison with a standard loaf baked daily, which had been previously given arbitrary scores.

METHOD OF PRESENTATION OF DATA

In this bulletin it is assumed that most of the wheats grown throughout the world are ground into flour for bread-making purposes; therefore in estimating quality in addition to milling quality, their

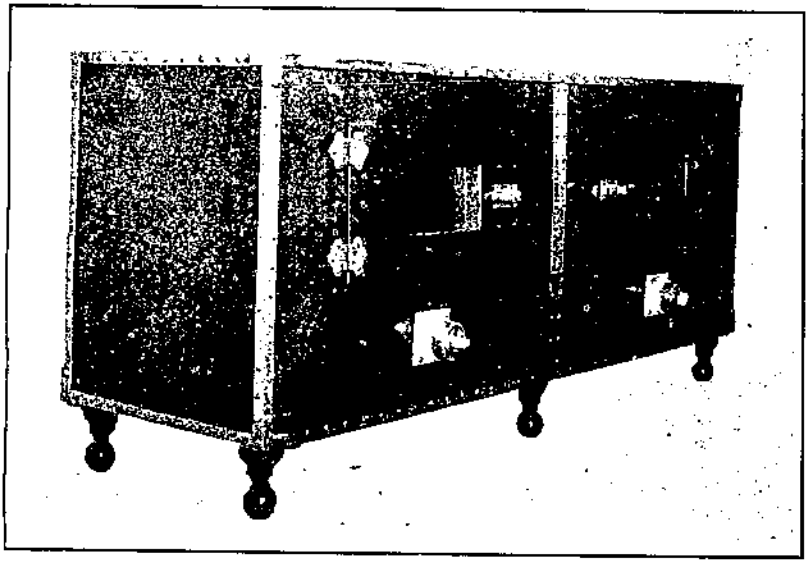

FIGURE 8.—Electric baking oven

utility for bread-making purposes has been used as the yardstick of quality. Further, the ability of the various flours to make bread that meets the American standards of bread making has been used as the basis of quality throughout. It is conceded that some of the wheats that prove inferior under this system of evaluation might make acceptable products if a different standard of baking quality were used.

To relieve the tables relating to the milling and baking qualities of the world's wheats of as many footnotes as possible, footnotes have been placed only on Tables 3, 4, and 5, but these footnotes apply in the same way to tables of identical form made up for the wheat of each country.

In evaluating the milling and baking properties of the various wheats, the average values found by Shollenberger and Clark (7) in their study of the milling and baking properties of the wheat varieties of the United States were taken as a guide.

For convenience and ease of discussion, the countries have been grouped according to continents, as follows: Africa, Asia, Europe, North America, South America, and Oceania. The milling and baking properties of the wheats of North America are discussed first.

MILLING AND BAKING QUALITIES OF NORTH AMERICAN WHEATS

The production of wheat in North America is in excess of 1,400,000,000 bushels. Canada, Mexico, and the United States produce this wheat.

CANADA

Wheat is Canada's most important crop. Production in 1928 exceeded 500,000,000 bushels. The crop is mainly spring grown, although some winter wheat is produced. The centers of wheat production are the plains Provinces of Alberta, Saskatchewan, and Manitoba, and the peninsula of Ontario.

In Ontario, the heavy snows and the lack of extreme winter temperature favor the production of winter wheat. The high rainfall (30 to 40 inches) and the humidity in this region create conditions favorable to the production of a soft wheat.

In southern Alberta, owing in part to the warming influences of the chinook winds, and to the shorter and milder winters as compared with the other western Provinces, the conditions are favorable to the production of winter wheat, but of a harder type. Nevertheless, the production of winter wheat in Canada during the period 1923–1928 did not exceed 5 per cent of the crop.

The spring-wheat belt of Canada adjoins the spring-wheat section of the United States. Over 75 per cent of the spring wheat is grown in the Provinces of Manitoba and Saskatchewan. The spring-wheat belt is limited on the north by a short growing season and low summer temperature; and on the southwest by insufficient rainfall.

CANADIAN VARIETIES

The commercially important varieties of wheat grown in Canada, the milling and baking qualities of which were tested, were Dawson Golden Chaff, (O. A. C. 61), Garnet, Huron, Kharkof, Kubanka, Marquis, Mindum, O. A. C. 104, Quality, and Ruby. The samples were obtained through the courtesy of A. G. O. Whiteside, cerealist, Central Experimental Farms, Ottawa, Canada.

Garnet, Marquis, and Ruby are hard red spring wheats. Garnet is a new variety with early-maturing characteristics and high productivity. In 1926, 12,000 acres were sown to Garnet in western Canada. Marquis comprises about 90 per cent of the spring wheat grown in Canada. It is sown principally in the prairie Provinces of Alberta, Manitoba, and Saskatchewan. Ruby is an early-maturing variety. The principal areas of production are in southeastern Manitoba and northern Alberta. The variety Garnet was grown at the experimental farm at Leacross; the variety Marquis was grown at the experimental farm at Scott, Saskatchewan; the variety Ruby was grown at the experimental farm at Morden, Manitoba. All samples were from the varieties grown in 1926.

The variety Huron, although regarded as a white wheat in Canada, is to be classified as a hard red spring wheat under the United States

standards for grain. Huron is the leading variety in eastern Canada; it is grown chiefly in eastern Ontario, Quebec, New Brunswick, and Nova Scotia. The sample tested was grown at the central experimental farm at Ottawa.

Kubanka and Mindum are durum varieties. Kubanka is said to be sown to about one-third of the acreage devoted to spring wheat in Manitoba. It is sown chiefly in southern Manitoba and southeastern Saskatchewan. It is believed that Mindum, which was recently introduced into Manitoba and southeastern Saskatchewan, will eventually occupy a considerable proportion of the acreage that is now sown to Kubanka. The sample of Kubanka was grown at the experimental farm at Brandon, Manitoba, whereas the variety Mindum was raised at the Winnipeg Agricultural College, both during the crop year 1926.

The production of hard red winter wheat in Canada is confined almost wholly to southwestern Alberta. The variety Kharkof, which was tested, is representative of this wheat. The sample was grown at the experimental farm at Lethbridge, Alberta, in 1926.

The varieties Dawson Golden Chaff, O. A. C. 104, and Quality, are white wheats. The first two are of winter habit; the last variety is of spring habit. Dawson Golden Chaff is representative of 60 per cent of the soft wheat grown in the Province of Ontario, and the variety O. A. C. 104 represents about 30 per cent. These two varieties are grown principally in the western section of the Province. The samples tested were grown at the Ontario Agricultural College at Guelph, during 1926.

The variety Quality is sown on about 5 per cent of the acreage devoted to hard spring wheat in the Province of Manitoba. It is found chiefly in the Brandon district. The sample tested was grown at the experimental farm at Brandon, Manitoba, in 1926.

Club wheat is not of commercial importance in Canada.

The data shown in Tables 3, 4, and 5 were obtained from milling and baking these samples in the manner described above.

TABLE 3.—*Wheats grown in Canada: Description and characteristics of the variety samples*

Laboratory No.	Province where grown	Variety	Predominating class	Grade	Dockage [1]	Kernel texture [1]	Test weight per bushel [1]	Weight per 100 kernels [1]	Damaged kernels [1]	Foreign material other than dockage [1]
					P. ct.	*P. ct.*	*Pounds*	*Grams*	*P. ct.*	*P. ct.*
14130	Alberta	Kharkof	Hard red winter	1 Dark Hard Winter	0.0	96.6	63.4	3.8	1.8	0.0
14126	Manitoba	Ruby	Hard red spring	1 Hard Spring	.3	88.4	61.5	2.7	1.6	.3
14128	do	Kubanka	Durum	1 Amber Durum	.0	99.2	61.3	3.8	.3	.2
14129	do	Mindum	do	4 Amber Durum	.0	91.6	61.6	4.3	8.8	.0
14133	do	Quality	White	1 Hard White	.0	99.6	60.0	4.0	1.3	.0
14127	Ontario	Huron	Hard red spring	3 Northern Spring	.0	69.0	60.5	3.4	6.2	.0
14132	do	O. A. C. 104	White	1 Soft White	.0	13.6	61.5	4.2	2.0	.0
14131	do	Dawson Golden Chaff	do	2 Soft White	.0	20.4	59.5	4.1	2.5	.0
14124	Saskatchewan	Marquis 10 B	Hard red spring	1 Hard Spring	.0	99.1	61.6	3.2	.6	.0
14125	do	Garnet	do	1 Hard Spring	.0	97.6	64.2	3.1	.0	.0

[1] Used in accordance with the Handbook of Official Grain Standards, United States grain standards act, G. I. Form No. 90 (9).

TABLE 4.—*Wheats grown in Canada: Milling properties of the variety samples described in Table 3, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel[1]	Screenings and scourings removed	Moisture of wheat before tempering[2]	Flour yield—		Wheat per barrel of flour[4]	Milling characteristics	Texture of flour	Color of flour		Ash in flour[5]	Ash in wheat[5]	Acidity of wheat[5] as—		Crude protein in wheat[5]	Crude protein in flour[5]	Glutenin in flour[5]	Gliadin in flour[5]	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)[5]
				Basis cleaned and scoured wheat[3]	Basis dockage-free wheat[3]				Visual	Gasoline value[5]			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14130	64.8	2.1	9.8	74.1	72.5	259	Hard	Granular	White	1.00	0.53	1.80	6.46	0.308	14.45	13.50	4.79	6.65	11.44	41.87	2.02
14126	63.4	1.9	10.0	73.2	71.8	262	do	do	do	1.07	.51	1.78	6.56	.389	12.19	11.25	4.39	5.13	9.52	46.11	2.01
14128	62.0	3.5	9.5	74.9	72.3	259	Very hard	do	do	1.20	.73	1.41	6.51	.239	15.59	15.19	5.34	8.03	13.37	39.94	2.83
14129	61.8	3.4	10.2	76.2	73.6	257	do	do	Creamy	1.63	.85	1.62	6.53	.246	13.29	12.89	4.27	6.65	10.92	39.10	2.51
14133	61.1	3.7	10.1	74.9	72.1	262	Soft	Soft	do	.78	.49	1.59	6.47	.250	13.04	12.07	4.35	5.95	10.30	42.23	1.88
14127	63.2	2.0	10.0	75.7	74.2	254	Hard	Granular	White	1.41	.63	1.95	6.38	.253	12.19	11.29	3.84	5.63	9.47	40.55	1.89
14132	61.7	2.7	9.8	74.3	72.3	260	Semihard	Soft	do	.79	.54	1.52	6.50	.288	8.14	7.20	2.78	2.85	5.63	49.38	2.49
14131	59.9	2.6	9.9	70.2	68.4	275	Soft	do	do	1.39	.51	1.39	6.60	.221	7.87	7.02	2.37	3.25	5.62	42.17	2.52
14124	62.5	1.8	9.8	70.1	68.9	273	Hard	Granular	do	.92	.48	1.02	6.72	.173	15.65	14.77	5.96	6.83	12.79	40.27	1.67
14125	64.9	1.9	9.5	74.1	72.6	258	do	do	do	1.38	.51	1.30	6.59	.239	12.57	11.77	4.38	5.83	10.21	46.60	2.14

[1] Determined on the cleaned and scoured grain.
[2] By the 130° C. air-oven method.
[3] Calculated to the moisture content of the wheat at time of milling.
[4] 196-pound barrel containing 13.5 per cent moisture.
[5] Made in accordance with the Methods of Analysis of Cereals and Cereal Products, published by the American Association of Cereal Chemists (*1*), the value 1.0 having the same intensity of color as an 0.005 per cent potassium solution.

TABLE 5.—*Wheats grown in Canada: Baking properties of the variety samples described in Tables 3 and 4*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour [1]	Volume of loaf [2]	Weight of loaf [1]	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour [3]
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14130	138	44	58.7	1,950	514	83	78	Poor, crumbly	Creamy gray	Pale	Poor	296
14126	134	65	59.0	2,220	506	88	89	Good	Creamy	Brown	Excellent	291
14128	141	60	61.8	2,060	518	86	92	do	do	do	Poor	299
14129	136	54	60.9	1,910	513	80	78	Fair, crumbly	Very creamy	do	do	296
14133	105	59	56.7	1,970	509	87	69	do	Creamy	do	do	293
14127	142	58	56.9	1,880	506	79	69	Poor, crumbly	Creamy gray	Light brown	do	291
14132	101	58	53.6	1,710	497	88	68	Fair	Creamy	Pale	do	287
14131	95	50	52.7	1,640	499	87	48	Poor	Creamy gray	do	do	288
14124	126	54	60.6	1,990	511	86	73	Fair, crumbly	do	Light brown	Fair	295
14125	133	61	59.9	2,180	522	86	85	Good	Creamy	Brown	Excellent	301

[1] 13.5 per cent moisture basis.
[2] Basis 340 grams of flour at a moisture content of 13.5 per cent.
[3] Basis 196-pound barrel of flour containing 13.5 per cent of moisture.

From the data in Tables 3 and 4, it is apparent that all the Canadian varieties examined were of excellent milling quality. The wheat kernels were plump in size, heavy in weight, and in most instances the samples were practically free from foreign material of any kind. The yield of flour obtained from each variety was high, showing that it would be possible to manufacture a barrel of flour from a considerably smaller quantity of this wheat than is usually necessary for this purpose.

The color of the flour milled from the hard red spring, hard red winter, and white wheats was white, whereas the durum wheats produced a creamy flour, as was to be expected.

The ash content of the bread-wheat flours was slightly above the average for these classes of wheats.

Judging the baking properties of these varieties of wheat from the appearance of the baked loaf (Table 5), only the varieties Garnet and Ruby, among the bread wheats, could be considered as having outstanding baking qualities. Kubanka appeared to be the best durum variety, and Quality appeared to be the best white variety. Of the two white wheats of winter habit, the variety O. A. C. 104 showed to the best advantage.

CANADIAN EXPORT WHEATS

The population of Canada does not require the entire supply of wheat produced. According to the statistics in Table 6, Canada ranks first among the wheat-exporting nations of the world. Of late years over 65 per cent of the crop has been exported.

TABLE 6.—*Wheat, including flour: International trade, average 1910–1914, annual 1925–1928*

Country	Year ended June 30—									
	Average 1910–1914		1925		1926		1927		1928, preliminary	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
PRINCIPAL EXPORTING COUNTRIES	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Canada	447	94,286	651	194,849	372	320,649	408	304,948	476	305,658
United States	1,808	194,967	6,201	260,802	15,670	168,035	13,284	219,160	15,734	206,259
Argentina	[1] 3	85,220	[2] 10	125,289	15	99,803	14	138,240	2	178,135
Australia	[1] 7	[1] 49,732	3	124,112	3	77,234	4	96,584	-------	72,962
British India [3]	[4] 332	[4] 50,821	49	45,209	1,327	8,054	2,428	11,088	1,788	14,328
Hungary	[3] 7,214	[3] 49,116	1,020	15,630	34	19,345	1	21,143	2	22,135
Russia	[3] 556	[3] 164,862	0	301	0	27,085	6	49,202	-------	-------
Yugoslavia [5]	0	0	0	9,570	0	11,549	0	30,034	[3] 0	[3] 1,150
Rumania	[3] 196	54,630	752	4,788	250	8,558	[3] 1	[3] 11,038	[3] 0	[3] 7,431
Algeria	[3] 639	[3] 5,036	[3] 2,702	1,892	[3] 1,182	6,007	[3] 3,584	2,182	[3] 1,597	6,351
Chile	[1] 170	[1] 2,593	2	8,822	731	1,696	758	516	622	585
Tunis	[3] 1,746	[3] 960	1,035	547	611	3,437	1,142	1,970	1,127	620
Bulgaria	[4] 0	[3] 11,182	[3] 1,943	323	[3] 5	4,128	[3] 1	2,236	-------	2,125
Spain	6,009	71	2	692	1,466	583	66	985	-------	-------
PRINCIPAL IMPORTING COUNTRIES										
United Kingdom	219,474	4,493	234,512	18,443	201,313	13,420	226,908	10,292	222,270	11,181
Italy	56,431	3,637	102,126	5,867	86,339	2,469	88,184	1,034	87,796	1,111
Germany	91,851	23,300	76,243	5,227	76,410	20,252	99,252	5,735	98,557	6,708
France	44,081	1,230	43,818	2,646	35,978	1,955	53,878	592	53,717	137
Belgium	72,877	21,965	45,135	5,791	42,722	3,701	41,235	1,378	44,607	2,651
Netherlands	[3] 80,702	[3] 58,435	30,623	4,507	29,150	1,699	29,060	867	31,534	586
Brazil [3]	20,495	0	28,892	17	27,452	22	31,143	38	[7] 32,216	([8])
Japan	[3] 4,116	[3] 28	15,265	1,985	27,980	4,899	18,458	4,014	21,995	4,850
China [1]	6,691	5,401	31,589	793	10,162	1,343	22,354	374	15,464	1,464
Czechoslovakia	0	0	23,902	[3] 888	19,388	212	21,085	89	21,323	41
Austria	[3] 11,402	[3] 871	16,406	[3] 254	14,822	[7] 171	16,888	89	16,239	165
Switzerland	[3] 16,937	[3] 14	14,355	0	14,245	0	17,226	0	18,427	0
Greece	[1] 7,035	[1] 2	[6] 21,791	[6] 0	[3] 18,590	[3] 0	19,502	0	-------	-------
Irish Free State	0	0	19,101	0	18,539	90	19,511	37	18,691	56
Sweden	[3] 7,080	[3] 23	11,481	107	6,677	639	8,484	[2] 2,576	10,391	1,660
Egypt	[3] 8,244	[3] 59	9,476	88	12,520	26	8,861	64	6,803	433
Denmark	[3] 7,155	[3] 597	7,265	796	6,886	897	7,605	1,085	10,704	220
Poland	0	0	[3] 16,571	[3] 23	3,460	5,080	8,331	833	7,840	225
Union of South Africa	[1] 6,274	[1] 253	6,773	16	6,063	15	4,110	8	8,212	8
Norway	[3] 3,674	[3] 0	5,489	[3] 16	6,346	[3] 5	5,944	[3] 4	6,862	[3] 4
Cuba	4,248	0	6,019	0	5,773	0	-------	-------	-------	-------
Finland	[1] 4,012	[1] 0	4,212	0	4,879	0	4,854	0	5,499	0
New Zealand	[1] 163	[1] 918	3,007	2	2,978	1	2,762	1	1,032	1
Syria and Lebanon [9]	0	0	2,065	0	3,168	0	1,980	0	-------	-------
Latvia	0	0	[6] 1,963	[3] 20	[6] 1,579	[3] 2	[6] 1,690	[3] 50	-------	-------
French Indo-China [5]	0	0	1,089	0	1,094	0	1,143	0	-------	-------
Estonia	0	0	849	0	952	0	902	0	1,052	0
Ceylon [5]	0	0	791	0	896	0	927	0	-------	-------
Total	692,969	795,602	794,787	840,312	688,066	763,161	784,030	898,486	762,580	849,354

Bureau of Agricultural Economics. Official sources except where otherwise noted.

[1] Average of calendar years, 1909–1913.
[2] Year ended Dec. 31.
[3] Sea-borne trade only.
[4] Includes some land trade.
[5] Year ended July 31, International Yearbook of Agricultural Statistics.
[6] International Crop Report and Agricultural Statistics.
[7] International Yearbook of Agricultural Statistics.

Through the courtesy of the Superintendence Co., samples of Canadian wheat, representing 144 cargo shipments unloaded in European ports, were received for testing; 140 of these cargoes were of hard red spring wheat, 2 were of durum wheat, and 2 were of white wheat. It is questioned whether the white wheats were of Canadian

origin, as the classification assigned, western white, would indicate a substantial percentage of club wheat, a type of wheat not of commercial importance in Canada.

Of the 140 cargoes of hard red spring wheat, 135 lots were representative of all the Canadian grades represented by the 1926 crop. Thirty-one samples were representative of No. 1 Manitoba Northern wheat; 33 of No. 2 Manitoba Northern; 28 of No. 3 Manitoba Northern; 14 of No. 4 Manitoba Northern; 7 of No. 5 Manitoba Northern; 3 of No. 6 Manitoba Northern ; and 1 of Feed wheat. In addition there were studied 3 samples of wheat representative of the Canadian grade No. 1 Manitoba Northern, Tough; 12 samples of the grade No. 2 Manitoba Northern, Tough; and 3 samples of the grade No. 3 Manitoba Northern, Tough.

It is to be regretted that the "tough" wheat could not have been milled with its original moisture content, as the milling and baking results obtained after drying out the wheat are virtually the same as the results obtained on the samples of the same grade without the designation "tough." If it can be conceded that the moisture content of the tough wheat was the average of the spread allowed in the grade Tough (14.4 to 16.9 per cent), 15.6 per cent, the figures for flour yield as well as the test-weight values would be reduced by approximately 3 per cent.

The complete data relative to the milling and baking qualities of all the samples of Canadian wheat studied are given in Tables 7, 8, and 9. For convenience, the data pertinent to the hard red spring wheat samples are summarized in Table 10.

TABLE 7.—*Canadian export wheats: Port and date of loading and of unloading, and description and characteristics of samples taken at the port of unloading*

Laboratory No.	Port of loading	Date of loading	Port of unloading	Date of unloading	Predominating class	Trade designation	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
								P. ct.	*P. ct.*	*Pounds*	*P. ct.*	*P. ct.*
14471	Baltimore	Jan., 1927	Avonmouth, England.	Feb., 1927	Hard red spring	1 Manitoba Northern	1 Hard Spring	0.4	90.6	62.0	0.2	0.1
14150	Boston	do	Hamburg, Germany	Jan., 1927	do	do	do	.5	92.0	62.2	1.6	.3
13720	Montreal	July, 1926	Avonmouth, England.	July, 1926	do	do	do	.8	90.2	62.2	1.4	.0
14077	do	Oct., 1926	Hamburg, Germany	Nov., 1926	do	do	do	.4	94.4	62.8	.1	.1
14075	do	Nov., 1926	do	do	do	do	do	.7	91.0	62.1	.4	.0
14282	do	do	Avonmouth, England.	do	do	do	do	.3	96.8	61.7	.0	.1
14146	do	Dec., 1926	Hamburg, Germany	Jan., 1927	do	do	do	.7	93.4	61.7	.0	.2
13390	New York	Mar., 1926	Rotterdam, Holland	Apr., 1926	do	do	do	.5	93.8	62.5	.0	.0
13552	do	May, 1926	Hull, England	June, 1926	do	do	do	.4	93.8	61.7	.3	.3
13681	do	Aug., 1926	Copenhagen, Denmark.	Sept., 1926	do	do	do	.6	95.0	61.9	.3	.0
13923	do	Sept., 1926	London, England	Oct., 1926	do	do	do	.6	95.9	62.5	.2	.0
13938	do	do	Copenhagen, Denmark.	Sept., 1926	do	do	do	1.3	92.4	62.0	.2	.2
13939	do	Oct., 1926	do	Oct., 1926	do	do	do	1.1	93.2	62.1	.2	.2
14076	do	Nov., 1926	Hamburg, Germany	Dec., 1926	do	do	do	.4	96.1	62.6	.2	.2
14289	do	do	Hull, England	do	do	do	do	.5	95.7	61.4	.7	.1
14149	do	Dec., 1926	Hamburg, Germany	do	do	do	do	.4	92.8	62.1	.2	.1
14287	do	do	Hull, England	Jan., 1927	do	do	do	.6	95.2	62.4	.2	.2
14251	do	Jan., 1927	Copenhagen, Denmark.	Feb., 1927	do	do	do	.8	93.4	61.7	.3	.4
14450	do	Apr., 1927	do	Apr., 1927	do	do	do	.3	95.3	62.4	.3	.1
14561	do	May, 1927	do	June, 1927	do	do	do	.6	92.6	62.7	.0	.1
14562	do	do	do	do	do	do	do	.3	94.6	62.3	.0	.0
14651	do	June, 1927	do	July, 1927	do	do	2 Dark Northern Spring	.6	94.0	61.1	.2	1.2
14652	do	do	do	do	do	do	1 Hard Spring	1.6	93.6	61.8	.5	.3
14654	do	do	do	do	do	do	do	1.5	93.4	61.7	.9	.7
14653	do	July, 1927	do	do	do	do	do	1.0	91.7	61.7	.2	.1
13520	Philadelphia	Mar., 1926	Rotterdam, Holland	Apr., 1926	do	do	do	.7	95.4	62.0	.1	.0
14285	Portland, Me.	Dec., 1926	Avonmouth, England.	Jan., 1927	do	do	do	.3	95.4	62.8	.0	.1
14241	Vancouver	do	Stockholm, Sweden	Feb., 1927	do	do	do	.6	90.6	62.5	.8	.0
14257	do	do	Aarhus, Denmark	do	do	do	do	.3	91.4	60.9	2.0	.2
14442	do	Jan., 1927	Odense, Denmark	Mar., 1927	do	do	do	.5	94.0	61.5	.0	.0
14449	do	Feb., 1927	Randers, Denmark	May, 1927	do	do	do	.4	94.7	61.8	.4	.1
	Average							.6	93.6	62.0	.4	.2

13722	Montreal	July, 1926	Avonmouth, England.	Aug., 1926	Hard red spring	1 Manitoba Northern, Tough.	1 Hard spring	.8	96.2	62.3	.1	.1
14534	do	May, 1927	Hull, England	June, 1927	do	do	do	.6	90.8	61.6	.2	.2
14456	Philadelphia	Apr., 1927	London, England	May, 1927	do	do	do	.5	93.3	62.3	.7	.2
	Average							.6	93.4	62.1	.3	.2
14081	Boston	Nov., 1926	Hamburg, Germany	Dec., 1926	Hard red spring	2 Manitoba Northern	2 Dark Northern Spring	.7	75.1	61.1	2.2	.3
14151	do	Jan., 1927	do	Jan., 1927	do	do	1 Hard Spring	.7	89.5	61.9	.3	.5
13724	Montreal	July, 1926	Avonmouth, England.	July, 1926	do	do	1 Dark Northern Spring	1.1	83.8	61.2	1.1	.4
14281	do	Nov., 1926	do	Dec., 1926	do	do	1 Hard Spring	.5	93.0	61.1	.5	.1
14273	do	Jan., 1927	do	Jan., 1927	do	do	do	.7	92.5	61.0	.9	.5
14536	do	Apr., 1927	do	May, 1927	do	do	do	.6	88.4	60.8	.3	.4
14535	do	May, 1927	do	June, 1927	do	do	do	.5	92.0	60.8	.8	.2
13389	New York	Mar., 1926	Rotterdam, Holland	Apr., 1926	do	do	1 Dark Northern Spring	.6	89.2	61.0	.3	.4
13924	do	Sept., 1926	London, England	Oct., 1926	do	do	1 Hard Spring	.8	88.4	61.9	.8	.7
14002	do	Oct., 1926	Dunkirk, France	do	do	do	1 Dark Northern Spring	.7	79.6	61.9	.5	.4
14014	do	do	do	do	do	do	do	.4	78.5	62.2	.2	.6
14018	do	do	do	do	do	do	do	.4	80.6	62.1	.5	.5
14078	do	do	Hamburg, Germany	Nov., 1926	do	do	1 Hard Spring	.5	94.2	60.7	.3	.2
14079	do	Nov., 1926	do	do	do	do	1 Dark Northern Spring	1.0	82.6	61.9	.6	.4
14201	do	do	Hull, England	Dec., 1926	do	do	1 Hard Spring	.4	97.2	61.4	.2	.3
14156	do	Dec., 1926	Hamburg, Germany	do	do	do	do	.5	92.2	61.1	.9	.2
14280	do	Jan., 1927	Avonmouth, England.	do	do	do	do	1.1	92.9	60.3	.6	.7
14539	do	May, 1927	Hull, England	June, 1927	do	do	do	.4	92.4	60.6	.5	.7
14080	Philadelphia	Oct., 1926	Hamburg, Germany	Nov., 1926	do	do	1 Dark Northern Spring	.3	83.6	62.0	.9	.4
14282	St. John	Dec., 1926	Avonmouth, England.	Jan., 1927	do	do	1 Hard Spring	.8	92.6	60.9	.8	.5
14278	do	Jan., 1927	do	do	do	do	do	.6	88.4	61.3	1.2	.6
14252	San Francisco	Dec., 1926	Randers, Denmark	Feb., 1927	do	do	2 Dark Northern Spring	.4	94.0	60.6	3.2	.2
13553	Vancouver	Apr., 1926	Hull, England	June, 1926	do	do	do	.3	83.0	61.2	.9	.5
13721	do	June, 1926	Avonmouth, England.	Aug., 1926	do	do	1 Hard Spring	.8	89.5	61.7	.5	.1
14239	do	Nov., 1926	Stockholm, Sweden	Jan., 1927	do	do	2 Dark Northern Spring	.4	87.1	61.5	2.3	.2
14152	do	Dec., 1926	Hamburg, Germany	do	do	do	do	.3	91.4	60.7	2.6	.2
14240	do	do	Stockholm, Sweden	Feb., 1927	do	do	1 Hard Spring	.6	90.3	62.6	1.1	.1
14237	do	Jan., 1927	Helsingborg, Sweden	do	do	do	do	.5	95.0	62.0	.6	.2
14238	do	do	do	do	do	do	do	.5	89.0	61.2	1.3	.0
14445	do	do	Odense, Denmark	Mar., 1927	do	do	2 Dark Northern Spring	.6	87.2	62.2	3.2	.2
14484	do	do	Stockholm, Sweden	do	do	do	1 Hard Spring	1.0	85.2	62.4	1.1	.3
14451	do	Feb., 1927	Randers, Denmark	May, 1927	do	do	2 Dark Northern Spring	.4	87.7	61.9	2.3	.2
14483	do	Apr., 1927	Stockholm, Sweden	do	do	do	do	.8	84.9	61.4	1.6	.3
	Average							.6	88.2	61.4	8.5	.2

TABLE 7.—*Canadian export wheats: Port and date of loading and of unloading, and description and characteristics of samples taken at the port of unloading*—Continued

Laboratory No.	Port of loading	Date of loading	Port of unloading	Date of unloading	Predominating class	Trade designation	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
								P.ct.	*P.ct.*	*Pounds*	*P.ct.*	*P.ct.*
13725	Montreal	June, 1926	Avonmouth, England.	July, 1926	Hard red spring.	2 Manitoba Northern Tough.	1 Hard Spring	1.0	86.8	60.8	0.8	0.1
14537	do	May, 1927	do	June, 1927	do	do	do	.4	88.5	61.3	.9	.7
14538	do	do	do	May, 1927	do	do	do	.4	88.8	61.2	.6	.1
13555	New York	June, 1926	Hull, England	July, 1926	do	do	do	.8	90.4	60.7	.7	.4
13925	do	July, 1926	do	Sept., 1926	do	do	do	.7	86.8	61.3	.2	.5
14082	do	Nov., 1926	Hamburg, Germany	Nov., 1926	do	do	1 Dark Northern Spring	.6	92.9	61.6	.6	.1
14154	do	Dec., 1926	do	Dec., 1926	do	do	1 Hard Spring	.4	86.8	61.6	2.0	.6
14290	do	do	Hull, England	Jan., 1927	do	do	do	.5	87.6	61.8	1.9	.3
14454	Philadelphia	Apr., 1927	London, England	May, 1927	do	do	do	1.0	88.6	61.5	1.6	.3
14275	Portland, Me.	Dec., 1926	Avonmouth, England.	Jan., 1927	do	do	do	.7	90.5	61.4	.6	.6
14286	St. John	do	do	do	do	do	do	.7	85.2	61.2	1.1	.4
14466	do	Jan., 1927	do	Feb., 1927	do	do	1 Dark Northern Spring	1.5	83.6	61.2	1.6	.5
	Average							.7	87.2	61.3	1.0	.4
14007	Baltimore	Oct., 1926	Dunkirk, France	Nov., 1926	Hard red spring.	3 Manitoba Northern.	2 Dark Northern Spring.	.5	76.2	60.5	2.5	.3
14008	do	do	do	do	do	do	3 Dark Northern Spring.	.8	79.9	59.9	5.8	.7
14010	do	do	do	do	do	do	do	.7	81.4	60.2	5.4	.2
14083	Boston	do	Hamburg, Germany	do	do	do	do	.8	75.4	61.1	5.8	1.0
13726	Montreal	July, 1926	Avonmouth, England.	July, 1926	do	do	2 Northern Spring	.7	71.7	60.7	1.5	1.1
14032	do	Sept., 1926	Swansea, Wales	Sept., 1926	do	do	1 Dark Northern Spring	.7	75.1	60.8	1.7	.7
14084	do	Nov., 1926	Hamburg, Germany	Nov., 1926	do	do	2 Dark Northern Spring.	.6	80.6	60.4	3.6	.6
13554	New York	June, 1926	Hull, England	July, 1926	do	do	do	.8	78.0	60.1	2.2	.3
13953	do	Sept., 1926	London, England	Oct., 1926	do	do	do	1.1	78.6	60.3	2.3	.5
14153	do	Dec., 1926	Hamburg, Germany	Jan., 1927	do	do	3 Dark Northern Spring.	.5	79.6	61.0	5.6	.3
14254	do	Jan., 1927	Copenhagen, Denmark.	Feb., 1927	do	do	do	.7	77.3	60.4	6.0	.7
14563	do	Apr., 1927	do	June, 1927	do	do	4 Dark Northern Spring.	.7	76.8	60.8	7.6	.5
14470	do	do	Hull, England	May, 1927	do	do	3 Northern Spring	.4	66.3	60.4	4.6	.4
14085	Philadelphia	Oct., 1926	Hamburg, Germany	Nov., 1926	do	do	3 Dark Northern Spring	.6	76.0	60.8	4.6	.7
14148	do	Dec., 1926	do	Jan., 1927	do	do	do	1.1	80.4	59.8	6.1	.7
14276	St. John	do	Avonmouth, England.	do	do	do	2 Dark Northern Spring.	.4	82.1	60.1	2.5	.4
14147	West St. John	do	Hamburg, Germany.	do	do	do	3 Dark Northern Spring.	.8	77.3	60.0	1.2	.2
13387	Vancouver	Feb., 1926	Rotterdam, Holland.	Apr., 1926	do	do	1 Dark Northern Spring.	.6	77.6	60.8	5.8	.2

13682	do	Aug., 1926	Copenhagen, Denmark.	Sept., 1926	do	do	3 Northern Spring	1.4	73.2	60.1	6.5	.2
14238	do	Nov., 1926	Hull, England	Jan., 1927	do	do	3 Dark Northern Spring	.7	81.2	60.5	6.0	.4
14292	do	Jan., 1927	do	Feb., 1927	do	do	3 Northern Spring	.5	69.7	60.9	5.3	.4
14463	do	do	Avonmouth, England.	do	do	do	4 Dark Northern Spring	.6	78.0	60.6	8.9	.2
14457	do	do	Hull, England	Mar., 1927	do	do	do	.7	78.7	60.5	7.2	.1
14447	do	Feb., 1927	Odense, Denmark	May, 1927	do	do	3 Dark Northern Spring	.8	78.1	61.0	5.6	.2
14541	do	Apr., 1927	Avonmouth, England.	do	do	do	do	.5	82.0	60.8	4.9	.2
14542	do	May, 1927	do	do	do	do	3 Northern Spring	.7	72.7	60.5	7.0	.5
14556	do	do	Aarhus, Denmark	June, 1927	do	do	3 Dark Northern Spring	.4	78.1	60.7	5.2	.4
14559	do	do	Copenhagen, Denmark.	do	do	do	do	.6	76.6	60.4	5.4	.2
	Average							.7	77.1	60.5	4.9	.4
13391	Baltimore	Mar., 1926	Rotterdam, Holland.	Apr., 1926	Hard red spring	3 Manitoba Northern Tough.	2 Dark Northern Spring	.8	84.8	59.7	2.3	.1
14472	do	Feb., 1927	Avonmouth, England.	Mar., 1927	do	do	do	.9	75.2	60.3	3.7	.6
14155	Boston	Dec., 1926	Hamburg, Germany.	Jan., 1927	do	do	3 Dark Northern Spring	.4	84.6	60.8	4.7	.5
	Average							.7	81.5	60.3	3.6	.4
13727	Montreal	July, 1926	Avonmouth, England.	July, 1926	Hard red spring	4 Manitoba Northern	4 Northern Spring	1.7	70.6	59.2	9.3	1.0
14256	New York	Jan., 1927	Copenhagen, Denmark.	Feb., 1927	do	do	5 Dark Northern Spring	.6	80.3	60.2	14.4	.1
14453	do	Feb., 1927	do	Mar., 1927	do	do	Sample Dark Northern Spring.	1.0	79.7	60.1	17.3	.4
14444	do	Mar., 1927	do	Apr., 1927	do	do	Sample Northern Spring	.6	69.4	59.9	18.0	.7
14443	Vancouver	Jan., 1927	Odense, Denmark	Mar., 1927	do	do	5 Dark Northern Spring	.9	75.9	60.7	13.7	.2
14458	do	do	Hull, England	do	do	do	Sample Dark Northern Spring.	.9	79.0	59.9	17.2	.2
14284	do	Feb., 1927	London, England	do	do	do	Sample Northern Spring	.4	70.4	60.1	18.8	.1
14448	do	do	Odense, Denmark	do	do	do	do	1.4	71.2	59.9	19.2	.2
14467	do	do	Avonmouth, England.	do	do	do	do	1.1	71.4	59.8	18.4	.4
14464	do	Mar., 1927	do	Apr., 1927	do	do	Sample Dark Northern Spring.	.8	75.1	60.6	18.1	.2
14545	do	Apr., 1927	do	May, 1927	do	do	do	.9	75.8	59.7	19.0	.3
14558	do	do	Copenhagen, Denmark.	June, 1927	do	do	do	.7	75.9	59.0	21.4	.6
14560	do	do	do	do	do	do	do	.8	76.2	60.2	16.1	.7
14557	do	do	Aarhus, Denmark	do	do	do	Sample Northern Spring	.6	61.6	58.9	28.8	.6
	Average							.9	73.8	59.9	17.8	.4

TABLE 7.—*Canadian export wheats: Port and date of loading and of unloading, and description and characteristics of samples taken at the port of unloading*—Continued

Laboratory No.	Port of loading	Date of loading	Port of unloading	Date of unloading	Predominating class	Trade designation	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
								P. ct.	*P. ct.*	*Pounds*	*P. ct.*	*P. ct.*
14544	Montreal	May, 1927	Avonmouth, England.	June, 1927	Hard red spring	5 Manitoba Northern	Sample Northern Spring	1.5	66.9	58.5	49.2	0.7
13683	New York	Aug., 1926	Copenhagen, Denmark.	Aug., 1926	do	do	5 Northern Spring	2.1	71.4	56.4	15.0	1.3
14455	Vancouver	Jan., 1927	Hull, England	Mar., 1927	do	do	Sample Northern Spring	.8	65.4	59.5	51.1	.3
14465	do	do	Avonmouth, England.	Feb., 1927	do	do	Sample Dark Northern Spring	1.6	75.3	59.7	41.3	.3
14274	do	Feb., 1927	London, England	Mar., 1927	do	do	do	.8	76.5	58.6	47.8	.4
14446	do	do	Odense, Denmark	do	do	do	Sample Northern Spring	1.6	69.8	59.5	38.6	.5
14546	do	Apr., 1927	Avonmouth, England.	Apr., 1927	do	do	Sample Dark Northern Spring.	1.0	76.1	59.6	43.5	.4
	Average							1.3	71.6	58.8	40.9	.6
13728	Montreal	July, 1926	Avonmouth, England.	July, 1927	Hard red spring	6 Manitoba Northern	Sample Northern Spring	2.7	62.4	57.2	43.4	3.6
14277	Vancouver	Feb., 1927	London, England	Mar., 1927	do	do	do	2.2	57.1	57.4	71.6	.6
14547	do	Apr., 1927	Avonmouth, England.	Apr., 1927	do	do	do	1.4	64.0	56.2	77.2	.7
	Average							2.1	61.2	56.9	64.1	1.6
14543	Vancouver	May, 1927	Avonmouth, England	May, 1927	Hard red spring	4 Commercial	5 Dark Northern Spring	1.4	75.6	60.4	14.1	.1
14549	Montreal	do	do	June, 1927	do	Feed	Sample Northern Spring	4.3	60.6	52.9	60.4	4.0
14036	Vancouver	Sept., 1926	do	Oct., 1926	do	No. 1 Sample	2 Dark Northern Spring	.6	82.0	58.8	0	.3
14468	Baltimore	Feb., 1927	do	Mar., 1927	do	Sample	Sample Northern Spring	1.6	70.6	59.3	17.4	.6
14469	St. John	do	do	do	do	do	do	1.9	74.1	59.6	15.8	.8
13723	Vancouver	June, 1926	do	Aug., 1926	do	Spring	1 Mixed (hard red spring, 83.8 per cent; soft red winter, 16.2 per cent).	.8	------	59.4	0	.4
	Average							1.8	72.6	58.4	18.0	1.0
14089	Montreal	Nov., 1926	Hamburg, Germany	Nov., 1926	Durum	2 Canadian Western Amber durum.	2 Durum	.5	67.9	62.3	2.6	.9
14088	do	do	do	Dec., 1926	do	3 Canadian Western Amber durum.	do	.7	47.8	61.6	3.6	1.3
	Average							.6	57.8	62.0	3.1	1.1

14039	Vancouver	Sept., 1926	Avonmouth, England.	Oct., 1926	White	No. 2 Sample White	2 Western White	.4		60.8	.2	2.0
13734	do	June, 1926	do	Aug., 1926	do	North	3 Western White (washed and scoured).	1.4		57.8	.1	.8
	Average							0.9		59.3	.2	1.4

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TABLE 8.—*Canadian export wheats: Milling properties of the samples described in Table 7, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Foreign material in wheat as milled	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
					Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*					*Per cent*		*Per cent*	*Per cent*	*Per cent*	
14471	62.1	1.3	0.0	12.7	72.2	71.5	272	Hard	Granular	White	1.07	0.50	6.62	0.242	13.47	13.01	2.24
14150	62.4	1.3	.2	11.1	71.6	71.0	269	do	do	do	1.32	.46	6.57	.228	13.67	12.39	1.75
13720	62.3	2.3	.0	11.3	72.0	70.9	270	do	do	do	.89	.50	6.37	.302	13.11	12.10	2.37
14077	63.1	1.5	.0	11.8	72.0	71.1	270	do	do	do	1.02	.49	6.72	.255	13.57	12.77	1.49
14075	62.5	2.1	.0	11.7	70.5	69.5	276	do	do	do	1.16	.49	6.69	.242	14.02	13.18	1.81
14282	62.1	1.7	.1	11.2	69.8	68.9	277	do	do	Slightly creamy	1.05	.47	6.53	.297	13.97	13.50	1.86
14146	62.0	1.2	.1	11.8	73.0	72.6	265	do	do	White	1.15	.50	6.57	.238	14.09	13.26	1.76
13390	61.8	1.6	.0	12.2	72.8	72.0	268	Semihard	Soft	do	1.39	.46	6.43	.302	13.59	12.80	2.08
13552	61.6	1.5	.1	12.1	72.5	71.7	269	Hard	Granular	do	1.00	.50	6.55	.307	12.82	12.40	1.88
13681	62.4	2.2	.0	11.5	73.0	71.9	266	do	do	Slightly creamy	1.35	.49	6.37	.282	13.20	12.73	1.62
13923	62.3	2.4	.0	10.7	72.6	71.3	266	do	do	White	.78	.47	6.40	.247	13.41	12.65	1.95
13938	62.2	3.0	.1	11.1	71.1	69.9	273	do	do	Slightly creamy	.91	.45	6.36	.297	13.17	12.69	1.93
13939	62.1	2.7	.0	11.2	71.5	70.3	272	do	do	White	.80	.45	6.58	.243	13.41	12.61	1.69
14076	62.9	1.6	.0	11.8	71.2	70.4	273	do	do	do	1.12	.47	6.70	.235	13.81	13.06	1.76
14289	61.7	1.5	.0	12.2	70.4	69.7	277	do	do	do	.99	.44	6.48	.297	14.22	13.58	1.64
14149	62.4	1.2	.1	11.3	71.8	71.2	268	do	do	do	1.12	.46	6.54	.238	13.69	12.59	1.92
14287	62.7	1.8	.0	11.9	68.9	68.1	283	do	do	do	.90	.41	6.51	.325	13.73	13.26	2.05
14251	61.9	2.1	.2	11.1	72.0	71.1	268	do	do	Slightly creamy	.98	.43	6.56	.298	13.82	13.11	1.91
14450	62.1	1.1	.0	12.5	71.0	70.4	275	do	do	White	.71	.43	6.68	.223	14.06	13.29	1.89
14561	62.4	1.5	.0	12.6	73.2	72.5	268	do	do	Dirty creamy	1.07	.46	6.61	.260	13.41	13.03	2.02
14502	62.3	1.3	.0	12.5	72.7	71.9	270	do	do	White	1.14	.46	6.65	.256	12.69	12.03	1.99
14651	62.1	1.8	.0	12.2	72.7	71.8	269	do	do	Slightly creamy	1.26	.50	6.49	.260	14.46	13.26	1.68
14652	62.1	3.3	.2	12.2	74.9	73.6	262	do	do	White	1.15	.52	6.54	.270	13.25	12.70	1.74
14654	61.8	2.7	.3	12.4	74.8	73.9	262	do	do	Slightly creamy	1.05	.54	6.51	.250	13.25	12.53	1.84
14653	62.0	2.1	.1	12.3	74.0	73.7	262	do	do	do	1.25	.50	6.55	.280	13.25	12.82	1.78
13520	61.5	1.5	.0	13.7	73.4	72.8	270	do	do	White	.84	.40	6.49	.248	13.64	12.96	2.38
14285	62.9	1.9	.0	11.5	70.3	69.2	277	do	do	do	.93	.39	6.38	.349	13.58	13.00	1.69
14241	62.6	2.0	.0	10.4	70.6	69.6	272	do	do	do	1.09	.43	6.45	.291	13.27	12.32	2.28
14257	61.5	4.0	.1	11.3	71.6	68.9	277	do	do	do	.73	.49	6.54	.317	14.15	13.33	2.15
14442	61.5	1.1	.0	12.2	71.7	71.4	270	do	do	do	1.00	.46	6.63	.236	14.15	13.52	1.99
14449	61.6	.9	.1	11.9	71.6	71.3	270	do	do	do	.72	.45	6.59	.241	14.19	13.49	1.88
Average	62.2	1.9	.1	11.8	72.0	71.1	271	do	do	Slightly creamy	1.03	.47	6.54	.270	13.62	12.90	1.90
13722	62.5	1.8	.0	11.1	71.5	70.8	269	do	do	White	1.01	.50	6.40	.291	13.23	12.56	1.86
14534	61.2	1.4	.1	11.3	70.3	69.7	274	do	do	do	.82	.45	6.62	.257	13.48	12.74	2.03
14456	62.0	1.0	.0	11.9	71.1	70.7	272	do	do	do	.76	.43	6.63	.222	13.81	12.77	1.69
Average	61.9	1.4	(1)	11.4	71.0	70.4	272	do	do	do	.86	.46	6.55	.257	13.51	12.69	1.86

14081	61.1	2.2	.3	11.5	71.4	70.3	273	do	do	do	1.46	.53	6.67	.280	12.51	11.54	1.78
14151	62.0	1.5	.1	11.4	71.8	71.2	269	do	do	do	1.36	.49	6.52	.247	13.50	12.18	1.84
13724	61.3	2.5	.3	10.9	70.7	69.7	273	do	do	Slightly creamy	1.08	.51	6.39	.242	11.78	10.79	1.90
14281	61.3	1.9	.2	11.1	71.5	70.5	270	do	do	White	1.18	.45	6.57	.312	13.96	13.14	1.86
14273	61.1	1.8	.3	11.3	70.6	69.8	274	do	do	do	1.06	.47	6.45	.383	13.71	12.87	2.08
14536	60.5	1.5	.2	12.3	70.8	70.2	275	do	do	do	.94	.48	6.68	.278	13.77	13.14	1.76
14535	60.4	1.3	.0	11.3	69.4	69.5	275	do	do	do	.93	.45	6.68	.275	14.05	13.34	1.82
13389	60.4	1.9	.1	12.5	72.5	71.6	271	do	do	do	1.22	.52	6.40	.266	12.86	12.22	1.97
13924	61.7	2.7	.3	11.8	71.8	70.5	273	do	do	do	.98	.49	6.38	.274	12.90	11.86	1.75
14002	62.1	2.9	.2	9.6	70.4	68.8	273	do	do	do	1.20	.53	6.53	.282	12.32	11.75	1.70
14014	62.3	2.1	.3	9.9	70.2	69.0	273	do	do	do	1.02	.46	6.68	.279	12.34	11.74	1.96
14018	62.3	2.1	.1	9.6	72.1	70.9	265	do	do	do	1.19	.49	6.71	.287	12.37	11.79	1.72
14078	61.0	2.0	.1	11.4	69.9	68.8	278	do	do	do	1.38	.55	6.73	.234	14.35	13.73	1.66
14079	62.2	2.4	.1	11.3	71.4	70.4	271	do	do	do	1.31	.56	6.72	.293	12.66	11.99	1.80
14291	61.9	1.5	.0	11.5	71.5	70.8	271	do	do	do	.96	.43	6.47	.306	14.19	13.62	1.89
14156	61.1	1.6	.0	11.1	69.7	68.9	276	do	do	do	1.26	.45	6.60	.242	13.82	12.86	1.96
14280	60.9	2.5	.1	11.1	70.1	69.8	273	do	do	do	1.18	.41	6.55	.306	14.12	13.25	1.49
14539	60.3	1.2	.0	11.5	69.4	68.8	278	do	do	Slightly creamy	.90	.42	6.66	.276	13.73	13.07	1.85
14080	61.9	1.9	.1	12.2	71.5	70.4	274	do	do	White	1.31	.54	6.65	.251	12.70	12.22	2.02
14283	61.2	2.5	.2	11.4	71.1	69.9	274	do	do	do	1.03	.42	6.54	.325	13.92	13.34	1.92
14278	61.9	2.0	.1	11.5	70.5	69.6	275	do	do	Slightly creamy	.97	.44	6.49	.316	13.24	12.79	1.85
14252	61.0	1.8	.1	11.2	71.4	70.4	271	do	do	White	.91	.45	6.54	.289	14.66	13.78	1.78
13553	61.5	1.7	.0	13.2	72.7	71.9	272	do	do	do	.94	.52	6.60	.280	12.65	11.74	2.03
13721	61.8	2.1	.0	11.3	70.3	69.4	275	do	do	do	1.14	.50	6.39	.297	13.11	12.74	2.02
14239	61.6	2.5	.1	10.3	70.1	68.6	275	do	do	do	1.01	.42	6.40	.333	13.40	13.04	2.03
14152	61.0	1.3	.1	11.9	70.8	70.1	274	do	do	do	1.19	.49	6.55	.242	13.87	12.60	1.96
14240	62.6	2.2	.1	10.4	70.8	69.6	272	do	do	do	1.05	.43	6.42	.305	13.13	12.68	2.12
14237	62.2	2.3	.1	10.2	70.8	69.5	272	do	do	do	1.08	.41	6.52	.327	13.75	12.95	1.91
14238	61.3	2.4	.0	10.2	70.7	69.3	272	do	do	do	1.24	.45	6.46	.333	13.98	13.26	1.88
14445	62.0	1.1	.2	12.0	71.6	71.2	271	do	do	do	1.00	.48	6.60	.250	13.16	12.43	1.73
14484	62.4	1.8	.2	12.5	72.7	72.1	269	do	do	Slightly creamy	1.11	.45	6.60	.240	12.58	11.93	2.17
14451	61.7	1.3	.0	11.7	69.4	68.8	279	do	do	White	.67	.43	6.63	.235	13.56	12.96	2.41
14483	61.6	1.8	.2	12.5	73.0	72.2	268	do	do	Creamy	1.18	.47	6.63	.245	13.38	12.54	2.04
Average	61.5	1.9	.1	11.3	71.0	70.1	273	do	do	White	1.10	.47	6.56	.283	13.33	12.60	1.90
13725	61.1	2.5	.1	11.8	69.2	68.2	282	do	do	do	1.23	.52	6.29	.284	12.57	12.13	2.02
14537	61.1	2.1	.0	11.3	69.3	68.1	280	do	do	do	.91	.52	6.70	.239	13.48	12.82	1.91
14538	61.2	1.2	.1	13.1	71.6	71.0	274	do	do	do	.86	.44	6.68	.270	13.36	12.57	2.15
13555	60.7	3.5	.1	13.1	70.9	69.0	283	do	do	do	.86	.49	6.52	.256	13.27	12.46	1.93
13925	61.4	2.4	.2	11.9	72.3	71.1	271	do	do	do	1.07	.53	6.32	.279	12.67	12.14	1.83
14082	61.9	1.8	.0	11.7	71.8	70.9	272	do	do	do	1.26	.51	6.71	.250	13.10	12.45	1.79
14154	61.8	1.3	.2	12.1	70.4	69.8	276	do	do	do	1.34	.46	6.62	.247	13.32	11.97	2.21
14290	62.1	1.5	.1	12.5	70.8	70.1	276	do	do	do	1.10	.44			13.21	12.83	2.15
14454	61.4	2.0	.0	11.8	69.1	68.4	281	do	do	do	.73	.46	6.66	.222	13.36	12.91	1.91
14275	61.7	2.4	.2	11.5	71.3	70.1	273	do	do	do	.93	.46	6.38	.349	13.81	12.88	1.69
14286	61.8	2.0	.1	11.4	69.5	68.5	286	do	do	do	1.02	.44	6.50	.306	13.12	12.64	2.20
14466	61.3	2.2	.1	12.7	71.7	71.2	273	do	do	do	1.01	.48	6.56	.229	13.35	12.77	1.89
Average	61.5	2.1	(1)	12.1	70.7	69.7	277	do	do	do	1.03	.48	6.54	.266	13.22	12.55	1.97

[1] Trace

TABLE 8.—*Canadian export wheats: Milling properties of the samples described in Table 7, and certain chemical constituents of the wheats and of the flour made from them*—Continued

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Foreign material in wheat as milled	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
					Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*					*Per cent*		*Per cent*	*Per cent*	*Per cent*	
14007	60.8	2.6	0.1	10.0	70.7	69.2	272	Hard	Granular	White	1.03	0.49	6.52	0.308	13.01	12.36	1.78
14008	60.4	2.9	.2	9.9	70.2	68.7	274	do	do	do	1.13	.50	6.44	.302	13.22	12.56	1.90
14010	60.3	2.7	.1	10.2	69.2	67.8	278	do	do	do	.93	.45	6.44	.302	13.26	12.36	1.85
14083	61.1	2.0	.3	11.8	70.7	69.9	275	do	do	do	1.32	.56	6.67	.275	12.41	11.72	1.75
13726	60.8	2.5	.7	11.7	69.6	68.3	281	do	do	do	1.60	.51	6.38	.318	12.57	11.28	2.01
14032	61.2	1.7	.1	13.1	71.4	70.7	276	do	do	do	1.50	.53	6.55	.254	12.07	11.50	1.88
14084	60.7	2.2	.1	11.4	71.6	70.4	272	do	do	do	1.32	.50	6.70	.249	13.74	13.01	1.86
13554	60.2	2.3	.3	12.6	71.2	70.0	273	do	do	do	.92	.51	6.50	.309	13.12	12.47	1.81
13953	60.4	3.3	.3	11.5	71.0	69.4	276	do	do	do	1.10	.48	6.43	.291	12.83	12.18	1.84
14153	61.0	1.4	.0	11.2	70.1	69.5	276	do	do	do	1.22	.45	6.62	.247	13.32	11.97	1.88
14254	60.9	2.6	.3	10.8	70.1	68.7	274	do	do	do	.95	.48	6.50	.333	12.73	12.04	1.87
14563	61.2	1.5	.3	12.3	71.5	70.9	273	do	do	Slightly creamy	1.12	.47	6.60	.283	12.84	11.92	1.94
14470	60.6	1.5	.1	12.1	72.5	71.7	262	do	do	White	1.12	.49	6.60	.259	12.88	12.17	1.91
14085	60.8	2.5	.4	11.2	70.2	68.9	277	do	do	Slightly creamy	1.51	.52	6.65	.263	12.57	12.11	2.01
14148	60.2	1.7	.4	11.3	68.9	68.5	277	do	do	White	1.25	.47	6.46	.299	13.11	11.98	1.88
14276	60.3	2.0	.1	11.3	70.2	69.1	276	do	do	do	.81	.44	6.51	.383	13.63	12.90	1.77
14147	60.3	2.0	.1	11.1	72.5	71.7	266	do	do	Slightly creamy	1.32	.52	6.53	.266	13.38	12.71	1.69
13387	60.5	2.0	.1	12.5	73.1	72.1	269	do	do	White	.84	.47	6.40	.317	12.87	12.16	2.31
13682	60.7	3.2	.1	9.2	70.0	68.6	272	do	do	Slightly creamy	.98	.44	6.44	.349	12.75	12.22	2.09
14288	61.2	2.1	.4	11.9	68.4	67.4	286	do	do	White	1.10	.45	6.49	.335	12.83	12.16	1.87
14292	61.1	1.9	.2	12.1	68.9	67.9	284	do	do	do	1.12	.46	6.49	.335	12.17	11.47	1.86
14463	60.8	2.0	.1	12.1	69.6	68.6	283	do	do	Slightly creamy	.97	.48	6.59	.261	12.75	11.97	2.15
14457	60.7	1.9	.1	11.6	70.0	68.8	279	do	do	White	.73	.44	6.63	.235	13.25	12.39	1.94
14447	60.7	2.3	.1	12.0	70.9	69.8	276	do	do	do	.82	.49	6.59	.264	12.95	12.06	2.02
14541	60.6	1.4	.0	12.9	69.3	68.6	284	do	do	Slightly creamy	.88	.42	6.64	.280	13.20	12.27	1.89
14542	60.8	1.6	.2	13.0	71.7	71.0	274	do	do	do	.87	.48	6.62	.298	12.47	11.49	1.84
14556	60.7	1.5	.2	12.1	71.0	70.2	275	do	do	White	1.06	.50	6.63	.278	12.96	11.80	1.81
14559	60.6	1.5	.1	10.0	69.1	68.4	275	do	do	Slightly creamy	1.15	.47	6.66	.292	12.73	12.01	1.86
Average	60.7	2.1	.2	11.5	70.5	69.5	276	do	do	do	1.10	.48	6.54	.292	12.92	12.12	1.90
13391	59.3	2.1	.0	12.4	73.0	72.0	269	do	do	do	.90	.47	6.48	.322	13.40	12.85	2.07
14472	60.5	1.7	.3	12.0	70.5	70.0	275	do	do	White	1.07	.59	6.61	.280	13.05	12.63	1.90
14155	61.1	1.3	.2	11.4	71.0	70.4	272	do	do	do	1.31	.51	6.57	.266	13.28	12.25	1.86
Average	60.3	1.7	.2	11.9	71.5	70.8	272	do	do	do	1.09	.52	6.55	.289	13.24	12.58	1.94

13727	59.3	2.7	.8	12.1	69.1	68.4	282	do	do	do	1.43	.57	6.26	.334	11.80	11.22	1.99
14256	60.4	2.2	.1	11.4	69.9	68.7	279	do	do	do	.91	.49	6.51	.317	12.88	12.06	1.90
14453	59.6	2.4	.2	12.3	69.5	68.6	282	do	do	do	.88	.45	6.65	.269	13.14	12.40	2.08
14444	59.7	2.0	.4	12.2	70.6	69.6	277	do	do	do	.75	.49	6.63	.259	12.83	12.10	1.76
14443	60.6	2.0	.1	12.2	69.6	68.8	281	do	do	do	.90	.48	6.63	.376	12.68	11.88	1.87
14458	60.0	1.8	.1	11.7	69.7	69.1	277	do	do	do	.76	.46	6.59	.240	13.26	12.58	2.00
14284	60.5	2.3	.0	11.4	67.2	66.0	290	do	do	do	.85	.40	6.53	.335	12.89	12.00	1.92
14448	59.8	2.6	.1	11.9	70.1	69.3	277	do	do	do	.81	.51	6.44	.347	12.64	11.80	2.29
14467	60.1	2.1	.3	13.1	70.5	69.8	279	do	do	do	1.01	.54	6.58	.304	12.35	11.45	1.93
14464	60.6	1.4	.1	12.5	70.6	70.2	276	do	do	Slightly creamy	.76	.48	6.63	.279	12.50	11.93	2.02
14545	60.1	1.7	.2	13.2	71.2	70.6	276	do	do	do	1.07	.45	6.61	.299	12.57	11.39	1.92
14558	59.6	1.9	.2	12.5	68.6	67.8	286	do	do	do	1.15	.50	6.66	.292	12.10	11.03	1.86
14560	60.3	1.8	.2	10.9	68.4	67.7	281	do	do	Dark creamy	1.03	.48	6.58	.274	12.51	11.45	1.93
14557	59.5	2.2	.2	11.8	69.7	68.6	280	do	do	Slightly creamy	1.09	.55	6.61	.350	11.73	10.71	1.91
Average	60.0	2.1	.2	12.1	69.6	68.8	280	do	do	do	.96	.49	6.56	.305	12.56	11.71	1.96
14544	58.2	4.0	.5	13.0	67.8	66.1	295	do	do	do	.99	.55	6.59	.337	12.46	11.45	1.84
13683	56.9	4.2	.5	11.5	64.1	62.8	305	do	do	do	1.16	.52	6.48	.349	11.72	11.09	2.22
14455	59.6	2.4	.3	11.9	64.6	63.2	286	do	do	White	.82	.48	6.55	.304	12.40	11.36	2.68
14465	59.6	2.3	.1	13.1	69.3	64.1	300	do	do	Slightly creamy	.98	.50	6.59	.297	12.42	11.62	2.00
14274	59.5	3.1	.1	11.6	67.1	65.6	292	do	do	White	.83	.48	6.44	.426	12.93	12.44	1.86
14446	59.2	2.2	.1	12.1	67.6	67.2	287	do	do	do	.87	.53	6.48	.347	12.21	11.31	2.10
15546	59.4	2.3	.3	13.0	71.7	70.2	278	do	do	do	1.01	.51	6.57	.298	12.77	11.77	1.81
Average	58.9	2.9	.3	12.3	67.4	66.3	292	do	do	do	.95	.51	6.53	.399	12.41	11.58	1.99
13728	57.4	4.2	2.2	11.5	64.0	60.1	319	do	do	Slightly creamy	1.32	.60	6.26	.390	11.92	10.95	2.12
14277	58.3	4.8	.6	11.6	64.1	62.4	307	do	do	White	.90	.52	6.43	.373	12.77	11.05	2.33
14547	56.3	3.3	.4	13.3	66.1	64.8	302	do	do	Slightly creamy	.99	.60	6.61	.375	11.83	10.89	2.04
Average	57.3	4.1	1.1	12.1	64.7	62.4	309	do	do	do	1.07	.57	6.43	.379	12.17	10.96	2.16
14549	53.7	6.1	3.2	12.8	62.4	61.3	317										
14543	60.3	2.3	.0	12.9	71.0	70.4	277	do	do	Slightly creamy	.95	.50	6.60	.298	12.99	11.96	1.73
14036	60.2	2.4	.0	11.0	69.2	68.0	280	do	do	White	.79	.52	6.58	.258	13.10	12.14	2.05
14468	59.5	2.5	.2	12.9	69.0	68.3	285	do	do	do	1.09	.52	6.56	.300	12.85	12.09	1.81
14469	59.8	3.0	.3	12.9	69.3	68.6	284	do	do	do	.99	.52	6.56	.299	12.86	12.17	1.94
13723	60.0	2.6	.2	11.3	71.4	70.1	272	do	do	do	1.09	.62	6.39	.388	13.11	12.10	2.28
Average	60.0	2.6	.1	12.2	70.0	69.1	280	do	do	Slightly creamy	1.0	.54	6.54	.309	12.98	12.09	1.96
14089	62.0	3.1	.5	11.7	73.3	71.4	270	Very hard	do	Creamy	1.66	.66	6.75	.286	12.10	11.70	2.47
14088	61.5	3.1	.5	10.3	72.7	70.9	267	Hard	do	do	1.86	.67	6.60	.302	11.41	10.94	2.34
Average	61.8	3.1	.5	11.0	73.0	71.2	268	do	do	do	1.76	.66	6.68	.294	11.76	11.32	2.40
14039	61.2	2.5	.0	11.4	72.7	71.2	269	Soft	Soft	White	1.01	.62	6.56	.273	14.39	13.52	2.05
13734	58.2	4.6	.1	10.3	67.6	65.4	289	do	Very soft	do	1.83	.49	6.39	.289	9.80	8.89	2.14
Average	59.7	3.6	.1	10.8	70.2	68.3	279	do	Soft	do	1.42	.56	6.48	.281	12.10	11.20	2.10

TABLE 9.—*Canadian export wheats: Baking properties of the samples described in Tables 7 and 8*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14471	144	56	60.8	2,070	509	88	90	Good	Creamy, gray	Brown	Good	293
14150	137	60	58.0	2,070	508	87	87	do	Creamy	Light brown	do	293
13720	152	66	62.5	2,120	516	86	91	do	Creamy, gray	do	do	297
14077	134	62	57.6	1,960	505	84	88	do	Creamy	Brown	Fair	291
14075	130	60	61.6	2,040	518	81	80	Fair, crumbly	Very creamy	do	do	299
14282	130	63	59.9	2,000	511	87	90	Good	Creamy	do	Good	295
14146	135	58	58.4	1,980	512	87	85	Fair, crumbly	do	Light, brown	Fair	295
13390	114	59	59.5	2,070	514	88	92	do	Creamy, gray			296
13552	152	65	59.1	2,140	510	89	91	do	Light creamy, gray	Brown	Excellent	294
13681	156	64	59.6	2,120	504	91	91	Excellent	Creamy	do	do	291
13923	142	71	58.1	2,140	500	86	93	Good	do	do	Good	286
13938	139	55	57.8	2,110	500	90	89	Fair, crumbly	Light creamy	do	do	288
13939	140	60	58.1	2,030	503	87	88	do	do	do	Excellent	290
14076	120	55	59.2	1,950	516	89	86	do	do	do	Fair	297
14289	126	57	57.7	2,080	499	88	91	Good	Creamy	do	Good	288
14149	135	58	58.7	2,060	511	87	89	do	do	Light brown	do	295
14287	126	61	57.2	2,120	498	88	90	do	do	Brown	do	287
14251	130	59	56.1	2,050	501	87	89	Fair	Light creamy, gray	do	do	289
14450	142	64	64.1	2,130	505	87	90	Fair, crumbly	do	do	Excellent	291
14561	146	63	61.0	1,970	508	86	90	Good	Creamy	do	Good	293
14562	144	61	60.6	1,950	509	87	90	do	do	do	do	293
14651	152	60	61.4	2,000	508	79	86	Fair	Light creamy, gray	do	Fair	293
14652	148	65	60.9	2,010	507	86	88	do	do	do	do	293
14654	144	61	61.1	2,040	503	86	89	Good	do	do	Good	290
14653	145	67	59.3	1,970	501	76	86	Fair crumbly	Creamy, gray	do	do	289
13520	127	60	59.8	2,140	508	89	91	Good	Light creamy, gray			293
14285	128	60	59.3	2,120	510	91	90	do	Light creamy	Light brown	Good	294
14241	126	59	57.5	2,160	503	89	92	Excellent	Light creamy, gray	Brown	Fair	290
14257	137	62	58.5	2,110	505	88	92	Good	Creamy	do	do	291
14442	160	68	60.3	2,120	509	90	89	do	Light creamy	do	Good	293
14449	147	62	63.5	2,050	503	88	90	Fair, crumbly	do	do	Excellent	290
Average	138	61	59.6	2,061	507	87	89	Good	Creamy	do	Good	292
13722	153	65	61.5	2,170	511	89	93	Excellent	Light creamy, gray	do	Fair	295
14534	148	55	61.4	1,930	516	86	88	Good	do	do	Good	297
14456	148	66	62.9	2,080	509	88	88	Fair, crumbly	Light creamy	Foxy brown	Fair	293
Average	150	62	61.9	2,060	512	87	89	Good	do	Brown	do	295

14081	139	61	59.1	2,070	508	82	90	do	Creamy	Light brown	do	293
14151	137	59	58.7	2,130	510	87	89	do	do	do	do	294
13724	148	57	61.5	2,150	514	91	93	Excellent	Light creamy	Brown	Excellent	296
14281	133	64	57.9	2,020	505	87	90	Good	Creamy	do	Good	291
14273	133	66	57.1	2,010	505	86	90	do	do	Light brown	Fair	291
14536	142	58	60.3	1,920	507	86	88	do	Creamy, gray	Brown	Excellent	292
14535	143	57	59.9	1,940	503	85	88	do	do	do	do	290
13389	119	60	58.3	2,040	513	87	92	do	do			296
13924	151	69	56.7	2,070	490	87	94	Fair, crumbly	Creamy	Brown	Good	288
14002	126	58	56.9	2,000	503	82	80	do	Light creamy, gray	do	Poor	290
14014	134	63	59.2	2,080	509	87	91	Good	Creamy	Light brown	Good	293
14018	135	60	57.8	2,000	508	85	92	Fair	do	do	do	293
14078	135	60	57.5	2,010	505	80	88	Good	Creamy, gray	Brown	do	291
14079	133	60	58.6	2,040	504	82	87	Good, crumbly	Creamy	do	do	291
14291	127	58	59.0	2,050	508	89	90	Good	do	Light brown	do	293
14156	133	58	61.0	2,090	512	87	90	Fair	do	Brown	Fair	295
14280	126	66	57.6	2,040	505	86	90	Good	do	do	Good	291
14539	158	60	60.0	2,000	506	87	90	do	Light creamy, gray	do	Fair	291
14080	140	62	58.7	2,130	507	85	92	Excellent	Creamy	Light brown	do	292
14283	129	62	58.9	2,130	506	90	92	Good	Light creamy	do	Good	291
14278	132	65	58.5	2,150	505	87	90	do	Creamy	Brown	do	291
14252	132	59	57.8	2,140	504	88	88	Fair	Light creamy, gray	do	do	291
13553	158	63	59.0	2,140	511	89	92	Good	Creamy, gray	do	Excellent	295
13721	146	66	61.8	2,240	518	89	92	Excellent	Light creamy, gray	Light brown	do	299
14239	140	65	59.8	2,210	509	88	92	do	Creamy	Brown	do	293
14152	135	59	59.2	2,230	511	88	92	Good	do	Light brown	do	295
14240	133	60	59.4	2,110	510	89	92	Excellent	do	Brown	Good	294
14237	137	71	59.7	2,140	511	86	90	Good	Creamy, gray	do	Excellent	295
14238	133	60	58.6	2,160	509	89	91	Excellent	Creamy	do	do	293
14445	150	61	64.8	2,050	513	88	90	Good	Light creamy	do	Good	296
14484	131	54	62.3	2,130	518	92	91	do	Light creamy, gray	Foxy brown	Excellent	299
14451	153	59	62.9	2,050	512	88	90	Fair	Light creamy	Brown	Good	295
14483	133	58	60.4	2,060	506	90	90	Good	Light creamy, gray	Foxy brown	Excellent	291
Average	137	61	59.4	2,085	508	87	90	do	Light creamy	Brown	Very good	293
13725	142	65	60.6	2,200	508	86	91	do	do	do	Good	293
14537	140	61	61.3	2,010	508	84	89	do	Creamy, gray	do	Excellent	293
14538	157	61	62.4	1,940	511	87	90	Good, crumbly	Light creamy, gray	do	Fair	295
13555	168	62	61.0	2,030	503	87	92	Good	Creamy	do	Excellent	290
13925	151	67	58.7	2,140	505	87	93	Fair, crumbly	do	do	Good	291
14082	139	59	59.7	2,050	510	83	90	Good	do	do	Fair	294
14154	136	59	58.5	2,140	509	88	90	do	do	do	Good	293
14290	127	57	60.0	2,050	512	87	91	do	do	do	do	295
14454	162	64	63.6	2,110	514	88	88	Fair	Light creamy	Foxy brown	Excellent	296
14275	136	64	56.7	2,130	502	88	91	Good	Creamy	Brown	Good	289
14286	130	62	57.0	2,160	504	88	88	do	do	Light brown	do	291
14466	161	63	60.3	2,090	506	88	88	do	Creamy, gray	Brown	Fair	291
Average	146	62	60.0	2,088	508	87	90	do	Creamy	do	Very good	293

TABLE 9.—*Canadian export wheats: Baking properties of the samples described in Tables 7 and 8*—Continued

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14007	130	62	56.8	2,040	501	80	88	Fair, crumbly	Creamy, dark gray	Brown	Good	289
14008	125	61	57.9	2,140	503	81	86	do	Creamy, gray	do	do	290
14010	133	63	57.9	2,220	501	82	88	Fair	do	do	do	289
14083	143	62	60.1	2,120	508	83	89	Good	Creamy	do	do	293
13726	147	65	60.4	2,150	507	88	92	do	Light creamy	do	do	292
14032	140	63	59.1	2,160	502	84	92	do	Creamy	Light brown	do	289
14084	138	62	58.7	2,070	507	82	89	Good, crumbly	do	Brown	do	292
13554	157	63	59.2	2,180	505	88	93	Excellent	Light creamy	do	do	291
13953	121	64	58.5	2,320	506	87	92	Good	Light creamy, gray	do	do	29-
14153	134	61	58.0	2,180	508	87	90	do	Creamy	do	do	293
14254	132	64	58.1	2,130	508	87	87	Fair	Light creamy, gray	do	do	293
14563	148	65	61.6	2,030	514	86	91	Good, crumbly	Creamy	do	do	296
14470	139	63	60.5	2,170	505	88	90	Good	Creamy, gray	do	do	291
14085	139	63	58.7	2,110	504	84	92	Excellent	Creamy	do	Fair	291
14148	137	59	59.2	2,220	509	88	91	Good	do	Light brown	Excellent	293
14276	129	66	57.3	2,130	501	87	91	do	do	Brown	Good	289
14147	134	61	57.9	2,160	508	87	88	Fair, crumbly	do	do	do	293
13387	117	60	61.4	2,170	517	86	92	Good	do			298
13682	144	61	62.3	2,280	508	91	91	Excellent	do	Brown	Excellent	293
14288	129	57	61.0	2,150	511	87	89	Good	do	do	Good	295
14292	127	59	59.1	2,130	506	84	87	do	Creamy, gray	Light brown	do	291
14463	146	66	58.3	2,160	504	89	90	do	Light creamy	Brown	do	291
14457	152	64	62.7	2,100	513	88	89	Fair, crumbly	do	do	do	296
14447	164	65	63.0	2,160	517	86	88	Good, crumbly	do	do	Excellent	298
14541	149	59	62.4	2,110	512	90	90	Good	Light creamy, gray	do	Good	295
14542	147	58	63.2	2,040	513	86	89	Good, crumbly	Creamy, gray	do	do	296
14556	150	64	61.7	2,230	504	85	92	Good	Light creamy, gray	do	Excellent	291
14559	153	62	62.2	2,040	506	85	90	Good, crumbly	Creamy, gray	do	do	291
Average	139	62	59.9	2,146	507	86	90	Good	Creamy	do	Very good	292
13391	128	59	58.0	2,320	506	88	93	Good	Light creamy, gray			291
14472	150	61	59.8	2,220	506	87	89	Good, crumbly	Creamy, gray	Brown	Good	291
14155	137	58	58.4	2,040	510	86	84	Fair	Creamy	do	Fair	294
Average	138	59	58.7	2,193	507	87	89	Good	do	do	do	292
13727	143	62	61.2	2,130	509	84	92	Good	do	do	Good	293
14256	129	66	59.5	2,100	507	86	89	do	Light creamy, gray	do	do	292
14453	152	64	63.3	2,230	503	86	86	Fair, crumbly	do	do	Excellent	290
14444	159	65	62.5	2,190	511	87	88	Good, crumbly	do	do	Good	295
14443	167	68	62.7	2,290	510	88	88	Good	do	do	do	294

14458	142	62	62.7	2,220	502	88	89	Good, crumbly	do	do	Excellent	289
14284	123	62	62.1	2,190	514	87	89	Excellent	do	do	do	296
14448	155	64	63.0	2,100	512	78	86	Good	Creamy, dark gray	Light brown	Good	295
14467	149	65	62.0	2,180	510	86	88	Good, crumbly	Creamy, gray	Brown	do	294
14464	147	70	64.8	2,210	515	88	88	do	do	do	do	297
14545	156	60	60.0	2,210	510	88	90	Good	Light creamy, gray	do	Excellent	294
14558	150	61	65.5	1,990	511	80	87	Good, crumbly	Creamy, gray	Foxy brown	do	295
14560	150	70	61.8	2,130	507	84	88	do	Light creamy, gray	Brown	Good	292
14557	153	61	63.0	2,110	511	82	89	do	Creamy, gray	do	Excellent	295
Average	148	64	62.4	2,163	509	85	88	Good	Slightly creamy, gray	do	Very good	294
14544	149	53	64.9	2,080	519	83	88	Good, crumbly	Creamy, dark gray	do	Good	299
13683	144	58	63.3	2,180	507	85	90	do	Creamy, gray	do	do	292
14455	154	59	67.6	2,260	520	86	86	Good	Light creamy, gray	Foxy brown	do	300
14465	143	66	66.4	2,020	519	82	88	do	Creamy, dark gray	Brown	Excellent	299
14274	130	62	62.4	2,300	513	85	88	Excellent	Light creamy, gray	do	do	296
14446	157	64	66.2	2,150	513	80	84	Good	Creamy, dark gray	do	Good	296
14546	154	57	65.7	2,260	515	86	90	do	Light creamy, gray	Foxy brown	Excellent	297
Average	147	60	65.2	2,178	515	84	88	Very good	Dark creamy, gray	Brown	Very good	297
13728	146	62	63.3	2,180	520	75	89	Good, crumbly	Creamy, smutty, gray	do	Good	300
14277	127	60	64.6	2,160	520	83	88	Excellent	Creamy, gray	do	Fair	300
14547	158	51	66.5	2,240	515	82	88	Good	Creamy, dark gray	Foxy brown	Good	297
Average	144	58	64.8	2,193	518	80	88	do	Dark creamy, gray	Brown	do	299
14543	152	56	64.7	2,050	518	86	88	Good, crumbly	Creamy, gray	Brown	do	299
14549	159	53	67.8	2,200	516	64	82	Good	Smutty, gray	do	do	297
14036	105	48	56.4	1,650	506	80	45	Poor	Creamy, gray	do	Poor	291
14468	150	63	60.5	2,240	503	87	88	Good, crumbly	do	do	Good	290
14469	143	60	62.6	2,160	503	87	89	Good	do	do	do	290
13723	141	61	58.1	1,960	505	89	94	do	Creamy	do	Fair	291
Average	142	57	62.0	2,043	508	82	81	do	Creamy, gray	do	Good	293
14089	131	63	58.9	1,970	508	84	90	Excellent	Very creamy	do	Poor	293
14088	129	64	59.8	2,050	505	83	89	Good	do	do	do	291
Average	130	64	59.4	2,010	506	84	90	Very good	Very creamy	do	do	292
14039	101	57	57.2	2,240	499	92	93	Excellent	Light creamy	do	do	288
13734	127	60	54.5	1,990	494	88	88	Poor	Creamy	Light brown	Fair	285
Average	114	58	55.8	2,115	496	90	90	Fair	Slightly creamy	Foxy brown	do	286

TABLE 10.—*Summary of the milling and baking data obtained from the analysis of 135 cargoes of the 1926 crop of Canadian export spring wheat*

Canadian grade[1]	Samples analyzed	Dockage	Kernel texture	Test weight per bushel[2]	Foreign material other than dockage	Damaged kernels	Moisture of wheat before tempering	Test weight after cleaning and scouring[3]	Screenings and scourings removed	Foreign material in wheat as milled	Flour yield[4]— Basis cleaned and scoured wheat	Flour yield[4]— Basis dockage free wheat	Wheat per barrel of flour[5]	Color of flour— Visual	Color of flour— Gasoline value	Ash in flour	Acidity of wheat as— pH	Acidity of wheat as— Lactic acid
	No.	*P. ct.*	*P. ct.*	*Lbs.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*			*P. ct.*		*P. ct.*
No. 1 Manitoba Northern	31	0.6	93.6	62.0	0.2	0.4	11.8	62.2	1.9	0.1	72.0	71.1	271	Light creamy	1.03	0.47	6.54	0.270
No. 1 Manitoba Northern, Tough	3	.6	93.4	62.1	.2	.3	11.4	61.9	1.4	Tr.	71.0	70.4	272	White	.86	.46	6.55	.257
No. 2 Manitoba Northern	33	.6	88.2	61.4	.3	1.1	11.3	61.5	1.9	.1	71.0	70.1	273	do	1.10	.47	6.56	.283
No. 2 Manitoba Northern, Tough	12	.7	87.2	61.3	.4	1.0	12.1	61.5	2.1	Tr.	70.7	69.7	277	do	1.03	.48	6.54	.266
No. 3 Manitoba Northern	28	.7	77.1	60.5	.4	4.9	11.5	60.7	2.1	.2	70.5	69.5	276	Light creamy	1.10	.48	6.54	.292
No. 3 Manitoba Northern, Tough	3	.7	81.5	60.3	.4	3.6	11.9	60.3	1.7	.2	71.5	70.8	272	White	1.09	.52	6.55	.289
No. 4 Manitoba Northern	14	.9	73.8	59.9	.4	17.8	12.1	60.0	2.1	.2	69.6	68.8	280	Light creamy	.96	.49	6.56	.305
No. 5 Manitoba Northern	7	1.3	71.6	58.8	.6	40.9	12.3	58.9	2.9	.3	67.4	66.3	292	White	.95	.51	6.53	.339
No. 6 Manitoba Northern	3	2.1	61.2	56.9	1.6	64.1	12.1	57.3	4.1	1.1	64.7	62.4	309	do	1.07	.57	6.43	.379
Feed wheat	1	4.3	60.6	52.9	4.0	60.4	12.8	53.7	6.1	3.2	62.4	61.3	317	Dirty gray	1.09	.60	6.50	.422
Total or average	135	.8	83.8	60.9	.4	7.4	11.7	61.0	2.1	.15	70.6	69.6	276	Light creamy	1.04	.48	6.54	.288

Canadian grade[1]	Crude protein in wheat	Crude protein in flour	Fermentation time	Proofing time	Water absorption of flour	Loaf volume	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Per cent	*Per cent*	*Minutes*	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
No. 1 Manitoba Northern	13.62	12.90	138	61	59.6	2,061	507	87	89	Good	Creamy	Brown	Good	292
No. 1 Manitoba Northern, Tough	13.51	12.69	150	62	61.9	2,060	512	87	89	do	Light creamy	do	Fair	295
No. 2 Manitoba Northern	13.35	12.60	137	61	59.4	2,085	508	87	90	do	do	do	Very good	293
No. 2 Manitoba Northern, Tough	13.22	12.55	146	62	60.0	2,088	508	87	90	do	Creamy	do	do	293
No. 3 Manitoba Northern	12.92	12.12	139	62	59.9	2,146	507	86	90	do	do	do	do	292
No. 3 Manitoba Northern, Tough	13.24	12.58	138	59	58.7	2,193	507	87	89	do	do	do	Fair	292
No. 4 Manitoba Northern	12.56	11.71	148	64	62.4	2,163	509	85	88	do	Light creamy	do	Very good	294
No. 5 Manitoba Northern	12.41	11.58	147	60	65.2	2,178	515	84	88	Very good	Dark creamy gray	do	do	297
No. 6 Manitoba Northern	12.17	10.96	144	58	64.8	2,193	518	80	88	do	do	do	Good	299
Feed wheat	12.44	11.42	159	53	67.8	2,200	516	64	82	Good	Smutty gray	do	do	297
Total or average	13.14	12.38	141	61	60.9	2,110	508	87	89	do	Creamy	do	do	293

[1] It is not possible to give the comparative grade under the United States grain standards act without referring to the individual sample in question.
[2] Dockage-free basis. [3] Based on cleaned and scoured grain. [4] Milled hard and granular. [5] Based on the weight of dockage-free wheat.

On the basis of the average figures given in Table 10 as the index of quality of the Canadian shipments, it is apparent that the wheat represented by the Canadian grades No. 1, No. 2, and No. 3 Manitoba Northern, was of excellent milling quality, especially the first two grades. The wheats of all three grades weighed at least 60 pounds per bushel, and were practically free from dockage, inseparable foreign material, and damaged kernels.

From the samples of each grade a high percentage of flour of high protein content, low ash, and good color was obtained. The water absorption of the flour was high, and except for the fact that the baked loaf in each instance was somewhat below the average size of loaf, the baking quality of all the flour milled from No. 1, No. 2, and No. 3, Canadian Northern hard red spring wheat was excellent.

On the other hand, the samples of wheats graded as No. 4, No. 5, and No. 6, Manitoba Northern, and the sample of Feed wheat were of progressively inferior milling quality as the grade changed from No. 4 to No. 6, and to Feed wheat. The undesirable factors that are indicative of poor milling quality such as a lower test weight and percentage of dockage, inseparable foreign materials, and damaged kernels, increased as the grade was lowered.

The flour milled from the samples of the lower grades was progressively poorer in color and higher in ash content. On the other hand, as is characteristic of frost-damaged wheat, the water absorption of the flour milled from these lower grades was noticeably higher than was the case with the flours milled from No. 1, No. 2, and No. 3 Manitoba Northern.

With the increased water absorption of the flour, the volume of the baked loaf from the flours milled from grades No. 4, No. 5, and No. 6, as well as Feed wheat was slightly larger, but the bread was of distinctly poorer color than that made from the flour milled from No. 1, No. 2, or No. 3 wheat.

The slightly greater size of the loaf of bread from No. 4, No. 5, and No. 6 Manitoba Northern, and from Feed wheat flour, is due, no doubt, to the condition of the gluten in the lower grades of wheat. The gluten in frost-damaged wheat, which is the predominating type in the lower grades of Canadian wheat, is somewhat weaker and more mellow than the gluten in sound wheat. Flour milled from frosted wheat would, therefore, tend to expand to a greater extent in the baking process, and the result would be a larger loaf.

The milling and baking qualities of the two samples of durum wheat were excellent. Judging from the samples of the white wheats, one cargo was of excellent quality, whereas the other was below average quality.

MEXICO

Production of wheat in Mexico averages about 11,000,000 bushels annually. There has been little increase in production since the World War. Very little wheat is imported, and practically none is exported.

The more important wheat-producing States in the order of their acreage in 1926 were Guanajuato, Coahuila, Michoacan, Sonora, Mexico, Chihuahua, and Neuvo Leone.

Climate, soil, and plant disease are the factors limiting the production of wheat in Mexico. Wheats produced in Coahuila, Chihuahua, and lower California are grown under irrigation. The chief wheats are

soft red winter and white. They are usually fall sown. Club wheats are occasionally grown.

Samples of the commercially important varieties of wheat grown in Mexico were obtained through the courtesy of Senor Juan A. Gonzalez, chief of the extension office at San Jacinto, Distrito Federal, Mexico. The names of the varieties tested and the State in which they are commercially important, are found in Table 11.

The majority of the varieties of commercial importance are white wheats, with a scattering of soft red winter wheat. If graded under the United States grain standards act, the majority of the Mexican wheats would be graded as mixed wheats on account of the presence of white wheat in red wheat, or vice versa.

From a milling standpoint and judging by the samples (Table 12), the white wheats of Mexico are slightly superior to the soft red winter wheats, as flour yields from the samples of white wheats were more uniform, and the quantity of wheat necessary to make a barrel of flour was slightly less with the white wheats than with soft red winter wheats.

The flour milled from the samples of Mexican wheats contained about the usual quantity of protein for the white and soft red winter classes of wheat. The flour was soft in texture, slightly creamy to white in color, and on the average was low in ash content. The water absorption of the flour from both classes of Mexican wheats was below the average usually associated with flour milled from similar classes of wheat grown in the United States.

The baking quality of the flour milled from the samples of Mexican wheats is shown in Table 13. The bread baked from the Mexican flours demonstrated that there was a wide variation in those factors which indicate baking strength. Fermentation time varied from 90 to 135 minutes, proofing time from 51 to 69 minutes, loaf volume from 1,690 to 2,660 cubic centimeters. Equally wide ranges occurred in the color, grain, and texture of the crumb of the loaf and the color of the crust. The flours milled from the wheats grown in Chihuahua had, on the average, the greatest baking strength. With the exception of one sample of wheat grown in Aguascalientes, which produced flour of an excellent milling quality, there does not appear to be any decided order of merit in which the wheat from the other States should be listed. The white wheats of Mexico appear to rank, as far as baking strength is concerned, along with those of Australia, and, with the exception of the white wheats grown in the United States, appear to have better baking strength than do any white wheats grown in any of the 38 countries that contributed wheat for this study.

UNITED STATES

Wheat is one of the most important crops grown in the United States. It is outranked in value only by corn, hay, and cotton and is the great bread crop of the Nation. About one-third of the farmers grow wheat. Production is above the pre-war level and averages over 800,000,000 bushels a year. Statistics on the production of wheat for the years 1920–1928 are given in Table 14. The data in this table are arranged according to the five commercial classes of wheat grown in the United States. More hard winter wheat is produced than of any other class, followed in order of production by hard red spring, soft red winter, white, and durum.

TABLE 11.—*Wheats grown in Mexico: Description and characteristics of the variety samples*

Laboratory No.	State where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					P. ct.	*P. ct.*	*Pounds*	*Gms.*	*P. ct.*	*P. ct.*
13418	Aguascalientes	Barbon y pelon	White	2 Hard White		82.7	59.2	3.5	0.1	
13566	Chihuahua	Chihuauense	Soft red winter	2 Red Winter	.0		59.8	2.7	.0	.1
13362	do	Bluestem Barbon	White	2 Hard White	.9	90.4	59.5	4.4	.1	.3
13363	do	Beardless Bluestem	do	do	1.5	83.6	59.3	3.8	.0	.1
13360	do	Chihuahueno Barbon	do	3 Soft White	.3	42.8	57.4	3.1	.0	.1
13361	do	Sonora	do	1 Western White	.5		60.4	3.4	.1	.0
13567	do	Australian white	do	do	.0		61.8	3.4	.0	.4
13412	Coahuila	Rojo	Soft red winter	3 Mixed (soft red winter, 87.1 per cent; white, 12.9 per cent.)[1]	.6		57.0	3.9	.0	.1
13416	do	Colorado Barbon	do	3 Mixed (soft red winter, 80.4 per cent; white, 19.6 per cent.)[1]	.5		57.1	3.5	.8	.0
13413	do	Beardless	White	2 Hard White	.0	75.1	59.8	3.4	.0	.0
13417	do	Colorado Barbon	do	1 Western White	.0		62.1	3.5	.1	.0
13415	do	do	do	1 Western White, smutty	.5		60.7	3.4	.5	.1
13414	do	White wheat	do	2 Mixed (white, 86.2 per cent; soft red winter, 13.8 per cent.)[1]	.0		58.7	3.8	.1	.0
13409	Guanajuato	Red bearded	Soft red winter	1 Mixed (soft red winter, 84 per cent; white, 16.0 per cent.)[1]	.2		61.0	3.8	.0	.1
13411	Lower California	Hard Federation	White	2 Hard White, smutty	2.3	78.2	59.5	3.8	.0	.4
13991	Mexico	Native bearded	Soft red winter	Red Winter				4.0	3.5	.0
13524	Queretaro	Red bearded	do	3 Red Winter	.0		57.3	3.4	.7	.0
13386	do	Rojo	do	2 Mixed (soft red winter, 78.3 per cent; white, 21.2 per cent; durum, 0.5 per cent.)[1]	.6		58.9	3.5	.0	.1
13525	do	White Beardless	White	4 Mixed (white, 70.4 per cent; soft red winter, 29.6 per cent.)[1]	.0		55.4	3.7	.0	.0
13407	Sonoro	Sonora	do	1 Western White	.6		61.0	3.2	.0	.0
13406	do	Defiance	do	3 Mixed (white, 75.2 per cent; soft red winter, 24.8 per cent.)[1]	.4		56.5	2.8	.0	.6
13408	do	Puebla	do	4 Mixed (white, 72.2 per cent; soft red winter, 27.8 per cent.)[1]	1.2		54.0	4.4	.0	.0

[1] Proportions of the classes found in the mixture.

TABLE 12.—*Wheats grown in Mexico: Milling properties of the variety samples described in Table 11, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13418	59.2	2.6	11.8	74.6	72.6	265	Soft	Soft	Slightly creamy	1.15	0.44	1.43	6.16	0.208	11.99	10.98	4.19	5.41	9.60	43.65	2.34
13566	60.1	1.5	13.0	72.2	71.1	274	do	do	White	1.23	.39	1.70	6.57	.323	7.41	6.30	2.32	3.06	5.38	43.12	2.56
13362	61.1	4.4	10.9	70.8	68.3	279	do	do	do	.88	.45	1.49	6.29	.212	13.39	11.25	4.20	5.66	9.86	42.60	2.39
13363	61.3	3.2	10.9	71.0	69.8	273	do	do	do	1.05	.45	1.30	6.38	.181	12.99	10.27	3.94	5.30	9.24	42.64	2.25
13360	59.2	1.3	11.4	71.5	70.6	274	do	do	do	1.05	.45	1.69	6.40	.176	10.48	9.34	3.41	4.63	8.04	42.41	2.43
13361	61.7	1.6	10.7	70.0	68.8	276	do	do	Creamy	1.82	.56	1.75	6.52	.216	10.52	9.27	3.49	4.39	7.88	44.29	2.22
13567	62.5	1.6	12.3	72.2	70.3	275	do	do	Slightly creamy	1.25	.40	1.69	6.56	.278	10.01	8.66	3.10	4.33	7.43	41.72	2.14
13412	58.9	2.8	11.6	70.2	68.2	281	do	do	White	1.02	.38	1.60	6.32	.259	8.95	7.57	2.70	3.87	6.57	41.10	2.59
13416	58.1	2.5	12.5	71.1	69.4	279	do	do	Slightly creamy	1.51	.64	2.16	6.35	.400	11.61	10.64	4.02	4.92	8.94	44.97	1.88
13413	60.0	2.0	11.7	73.4	71.9	267	do	do	White	1.15	.47	1.74	6.46	.360	11.00	10.09	3.73	5.16	8.89	41.96	2.31
13417	62.0	1.8	11.8	71.1	69.8	275	do	do	Slightly creamy	1.45	.62	1.58	6.30	.238	8.46	7.98	2.87	3.80	6.67	43.03	2.34
13415	62.0	1.8	12.2	72.2	70.9	272	do	do	Creamy	2.22	.56	1.60	6.50	.271	7.41	6.81	2.46	3.42	8.94	44.97	1.51
13414	59.6	1.5	12.1	72.3	71.2	271	dg	do	White	1.14	.42	1.95	6.44	.275	9.55	8.36	2.90	4.27	7.17	40.45	2.54
13409	61.2	1.8	11.4	73.1	71.8	266	do	do	do	1.26	.51	1.99	6.34	.434	9.51	8.87	3.33	4.10	7.43	44.82	2.17
13411	60.5	4.9	10.5	72.6	70.8	268	do	do	do	1.06	.62	2.11	6.37	.336	9.90	8.87	3.38	4.10	7.48	45.19	2.93
13524	59.0	2.0	13.1	69.8	68.5	285	do	do	Slightly creamy	1.32	.40	1.82	6.37	.272	10.49	9.13	3.17	4.83	8.00	39.63	2.22
13386	60.5	2.7	12.0	74.3	72.3	266	do	do	White	1.52	.43	1.86	6.53	.290	9.63	8.88	3.31	4.11	7.42	44.61	2.16
13525	56.8	.9	13.4	66.1	65.5	299	do	do	do	1.34	.43	1.79	6.46	.342	9.05	7.95	2.87	3.89	6.76	42.46	2.30
13407	61.9	2.0	10.8	71.8	70.4	270	do	Very soft	Slightly creamy	1.63	.55	1.77	6.45	.377	10.37	9.69	3.67	4.67	8.34	44.00	2.31
13406	57.1	3.0	10.9	70.9	68.8	277	do	Soft	do	1.49	.45	2.47	6.44	.422	10.87	9.79	3.68	4.67	8.35	44.07	2.25
13408	54.7	4.3	10.6	68.6	66.5	285	do	do	Creamy	1.72	.42	1.92	6.48	.400	10.42	9.08	3.51	4.35	7.86	44.66	2.58

TABLE 13.—*Wheats grown in Mexico: Baking properties of the variety samples described in Tables 11 and 12*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*P. ct.*	*C. c.*	*Gm.*	*Score*	*Score*					*Pounds*
13418	102	68	53.5	2,440	489	90	96	Very good	Light creamy			282
13566	119	63	52.4	1,770	489	88	88	Poor, crumbly	Creamy	Pale	Poor	282
13362	101	59	56.4	2,660	497	90	93	Very good	Light creamy			287
13363	99	59	53.6	2,080	496	88	90	Good	Creamy			286
13360	104	63	51.2	2,200	487	90	93	do	Light creamy			281
13361	104	62	55.8	2,190	500	89	90	do	Creamy			288
13567	115	57	52.6	1,900	491	88	88	Fair	do	Light brown	Fair	283
13412	101	69	53.5	2,060	494	85	91	Good, crumbly	Creamy, gray			285
13416	92	59	54.5	1,940	505	76	58	Poor, crumbly	Very creamy, gray			291
13413	111	66	52.7	2,160	493	89	92	Good	Light creamy			284
13417	90	62	55.2	1,740	503	81	76	Poor, crumbly	Very creamy			290
13415	95	68	55.2	2,080	486	86	91	Good	Light creamy, gray			280
13414	97	64	54.2	1,770	510	80	76	Poor, crumbly	Very creamy, gray			294
13409	105	61	53.0	1,930	497	83	88	Good, crumbly	Creamy, gray			287
13411	106	66	58.0	2,060	507	88	91	Good	Light creamy, gray			292
13991 [1]												288
13524	135	63	56.6	2,020	499	88	90	Good, crumbly	Creamy, gray	Light brown		290
13386	114	51	54.1	1,690	503	86	82	Fair	Creamy			284
13525	135	65	53.3	2,020	492	90	93	Good	Light creamy	Pale		287
13407	111	63	54.2	1,990	497	82	88	Fair, crumbly	Creamy, gray			287
13406	105	67	52.9	2,060	498	82	87	do	Creamy			282
13408	108	63	52.5	2,090	489	84	92	Good, crumbly	Very creamy			

[1] Not baked.

Hard red spring wheat is grown extensively in the north-central area in Iowa, Minnesota, Montana, North Dakota, and South Dakota.

Durum wheats are found in almost the same area, Iowa being the exception.

The hard red winter wheats are found in the central southwestern part of the country, particularly in Iowa, Kansas, Missouri, Oklahoma, and Texas and in parts of eastern Colorado, Idaho, and Wyoming.

TABLE 14.—*Wheat production, by classes, United States, 1920–1928*

Year beginning July—	Hard red winter	Hard red spring	Durum	Soft red winter	White	Total
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
1920	302,447	139,893	52,180	247,300	91,207	833,027
1921	290,050	131,075	56,974	237,393	99,413	814,905
1922	279,957	169,615	90,817	247,884	79,325	867,598
1923	241,852	128,876	55,255	271,631	101,767	797,381
1924	365,000	192,000	66,000	189,000	52,000	864,000
1925	206,000	156,000	65,000	170,000	80,000	677,000
1926	360,000	121,000	48,000	229,000	73,000	831,000
1927	317,042	201,927	83,162	180,887	95,356	878,374
1928	384,176	195,106	97,833	139,788	85,846	902,749

Based upon reports to the Division of Crop and Livestock Estimates and studies of the Bureau of Plant Industry.

The soft red winter wheats are grown mostly in the humid East Central States. Large acreages are sown to soft red winter wheat in Illinois, Indiana, Michigan, Missouri, Maryland, and Pennsylvania.

Both spring and fall-sown white wheats are found in the northwestern and northeastern parts of the country. Considerable common white wheat is grown in New York. In the Northwest, large acreages are devoted to the white wheats, especially in California, Idaho, Oregon, and Washington.

According to Clark, et al. (*2*) more than 200 distinct varieties of wheat are grown in the United States. This is natural, as wheat is produced commercially in all of the 48 States, under a wide range of environmental conditions. Many of these varieties are adapted only locally; others are well adapted to a wide range of conditions. Among the spring wheats grown the variety Marquis is the most important. In fact the area devoted to the production of Marquis wheat in 1924 exceeded 9,600,000 acres or to approximately one-fifth of the total wheat acreage of the country. Other prominent spring wheat varieties are Ceres, Kota, Preston, Ruby, and Power.

More than 14,000,000 acres are sown to hard red winter wheats. Turkey, Kanred, Kharkof, and Blackhull are the most important of the hard red winter group of wheats.

Fulcaster, Mediterranean, Poole, Leap, and Trumbull, are the foremost varieties of the soft red winter wheats.

Among the durum varieties, Kubanka, Kahla, Peliss, and Arnautka are extensively grown.

Representatives of the common white wheats (*Triticum vulgare*), Goldcoin, Baart, and Pacific Bluestem are outstanding varieties.

Of the club wheats (*T. compactum*) the variety Hybrid 128 is the leader.

From the standpoint of the uses to which the wheats produced in the United States are put, they may be grouped into three subdivisions. The hard red spring and the hard red winter wheats are essentially bread wheats; the soft winter and white wheats are used largely for pastry and biscuits and to some extent for bread; the durum wheats furnish semolina, which is used in the manufacture of such products as macaroni and spaghetti.

UNITED STATES VARIETIES

To compare the relative milling and baking properties of the wheats of the United States with those of similar usage and classification grown in other parts of the world, selected varieties representing the five commercial classes were milled and baked. The varieties Kanred, Kharkof, and Turkey were chosen to represent the hard red winter wheats; the varieties Kota, Marquis, Power, and Ruby, the hard red spring wheats; the varieties Kubanka, Mindum, and Nodak, the durum wheats; the varieties Fulcaster, Fultz, Harvest Queen, Minhardi, and Red Rock, the soft red winter wheats; and the varieties Pacific Bluestem, Federation, Hard Federation, Quality, and White Federation, the white wheats. To minimize the effect of changes in climate and soil conditions upon the relative merit of any given variety, samples of the variety under discussion were obtained from several sources as shown in Table 15. Other milling and baking data are found in Tables 16 and 17.

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TABLE 15.—*Wheats grown in the United States: Description and characteristics of the variety samples*

Laboratory No.	Locality where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13600	Dickinson, N. Dak.	Kota	Hard red spring	1 Dark Northern Spring	0.0	96.4	59.5		0.0	0.0
13573	North Platte, Nebr.	do	do	1 Dark Northern Spring, smutty	.1	93.6	59.5	2.3	1.1	.0
13770	Moccasin, Mont.	do	do	3 Dark Northern Spring	.0	96.4	59.9	3.1	6.2	.6
13571	North Platte, Nebr.	Marquis	do	1 Hard Spring	.0	95.0	60.2	2.6	.6	.0
13464	Davis, Calif.	do	do	1 Dark Northern Spring	.0	97.1	58.0	2.8	.1	.0
13598	North Platte, Nebr.	do	do	do	.0	99.9	59.2		.0	.0
13757	Moccasin, Mont.	do	do	2 Dark Northern Spring	.1	99.5	59.7	2.8	.3	.0
13688	Waterville, Wash.	do	do	5 Dark Northern Spring	.6	96.1	53.8	1.9	.9	.0
13687	Redfield, S. Dak.	do	do	Sample Dark Northern Spring	.0	98.4	47.1	1.6	.4	.0
13599	Dickinson, N. Dak.	Power	do	1 Dark Northern Spring	.0	97.4	59.8		.1	.0
13767	Moccasin, Mont.	do	do	do	.0	98.1	58.4	2.9	.6	.0
13769	do	Ruby	do	1 Hard Spring	.0	97.7	61.0	2.8	.8	.0
13604	Dickinson, N. Dak.	do	do	1 Dark Northern Spring	.2	95.2	59.3	2.3	.0	.0
13601	North Platte, Nebr.	do	do	3 Dark Northern Spring	.0	81.4	60.0		.6	.2
	Average				(1)	95.9	58.2	2.5	.8	(1)
13779	Moccasin, Mont.	Kubanka	Durum	1 Amber Durum	.0	96.1	60.2	3.5	.5	.0
13616	Dickinson, N. Dak.	Mindum	do	do	.0	97.0	60.6		.5	.0
13582	North Platte, Nebr.	Nodak	do	do	.0	91.1	60.2	3.3	1.4	.0
13617	Dickinson, N. Dak.	do	do	do	.0	97.2	60.5	2.9	.1	.0
13783	Moccasin, Mont.	do	do	do	.0	97.8	60.0	3.6	.1	.0
	Average				.0	95.8	60.3	3.3	.5	0.
13807	do	Kanred	Hard red winter	1 Dark Hard Winter	.0	95.8	62.0	3.6	.2	.0
13588	North Platte, Nebr.	do	do	2 Dark Hard Winter	.0	96.1	58.9		.2	.0
13625	Dickinson, N. Dak.	do	do	do	.1	96.4	58.5	2.7	.0	.0
13808	Moccasin, Mont.	Kharkof	do	1 Dark Hard Winter	.0	92.4	61.5	3.3	.0	.0
13587	North Platte, Nebr.	do	do	2 Dark Hard Winter	.0	96.2	59.5	2.6	.0	.0
13627	Dickinson, N. Dak.	do	do	do	.0	92.4	59.2	2.7	.0	.0
13445	Manhattan, Kans.	do	do	3 Dark Hard Winter	.3	84.5	56.7		.0	.0
13366	Hays, Kans.	do	do	4 Dark Hard Winter	.2	99.9	54.3	1.7	.2	.0
13689	Waterville, Wash.	do	do	do	.0	98.1	55.7	2.0	.1	.0
13465	Davis, Calif.	do	do	2 Hard Winter	.0	78.8	59.2	2.9	.0	.0
13626	Dickinson, N. Dak.	Turkey	do	1 Dark Hard Winter	.2	95.2	60.7	2.8	.0	.0
13802	Moccasin, Mont.	do	do	do	.2	98.3	61.1	3.3	.0	.0
13438	Manhattan, Kans.	do	do	2 Dark Hard Winter	.2	84.5	58.4	2.6	.0	.0

13442	----do----	----do----	----do----	----do----	.1	89.1	59.7	----------	.0	.0
15592	North Platte, Nebr.	----do----	----do----	----do----	.0	87.1	58.1	----------	.0	.0
	Average				(1)	92.3	58.9	2.7	(1)	.0
14333	Arlington, Va.	Fulcaster	Soft red winter	1 Red Winter	.1	----------	61.8	4.5	.3	.0
14349	State College, Pa.	----do----	----do----	----do----	.0	----------	61.2	4.9	.5	.0
13462	Manhattan, Kans.	----do----	----do----	2 Red Winter	.1	----------	59.7	3.2	.1	.0
13382	Hays, Kans.	----do----	----do----	4 Red Winter	.2	----------	55.6	----------	.0	.0
14338	Arlington, Va.	Fultz	----do----	1 Red Winter	.2	----------	62.4	3.8	.5	.0
13381	Hays, Kans.	Harvest Queen	----do----	3 Red Winter	.1	----------	56.8	2.3	.1	.0
13460	Manhattan, Kans.	----do----	----do----	----do----	.0	----------	57.4	2.4	.1	.0
13631	Dickinson, N. Dak.	Minhardi	----do----	3 Red Winter, smutty	.0	----------	56.0	2.3	.0	.0
14342	Arlington, Va.	Red Rock	----do----	1 Red Winter	.4	----------	60.0	4.2	.0	.0
	Average				.1	----------	59.0	3.4	.2	.0
13469	Davis, Calif.	Bluestem	White	4 Soft White	.2	72.0	54.6	2.8	.0	.1
13471	----do----	Federation	----do----	4 Hard White	.2	96.0	55.0	3.2	.0	.0
13693	Waterville, Wash.	----do----	----do----	----do----	.5	96.8	54.1	2.4	.2	.0
13470	Davis, Calif.	Hard Federation	----do----	1 Hard White	.2	98.8	60.7	4.1	1.5	.0
13593	North Platte, Nebr.	----do----	----do----	2 Hard White	.0	96.1	59.8	----------	1.7	.0
13632	Dickinson, N. Dak.	----do----	----do----	----do----	2.9	95.0	58.2	3.0	.2	.0
13692	Waterville, Wash.	----do----	----do----	3 Hard White	1.0	97.9	57.2	2.6	.0	.2
13594	North Platte, Nebr.	Quality	----do----	2 Hard White	.0	92.6	59.7	----------	.2	.0
13633	Dickinson, N. Dak.	----do----	----do----	----do----	.1	99.6	58.4	3.1	.1	.2
13695	Waterville, Wash.	----do----	----do----	4 Hard White	2.0	92.2	54.9	2.7	.0	.3
13473	Davis, Calif.	White Federation	----do----	1 Hard White	.0	99.9	60.3	4.3	.2	.0
	Average				.8	94.3	57.5	3.1	.4	(1)

[1] Trace.

TABLE 16.—*Wheats grown in the United States: Milling properties of the variety samples described in Table 15, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield— Basis cleaned and scoured wheat	Flour yield— Basis dockage-free wheat	Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour: Visual	Color of flour: Gasoline value	Ash in flour	Ash in wheat	Acidity of wheat as— pH	Acidity of wheat as— Lactic acid	Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13600	61.0	1.9	12.0	73.3	71.9	268	Hard	Granular	Creamy	1.36	0.52	2.10	6.47	0.338	17.62	16.37	6.39	7.63	14.07	45.42	1.98
13573	60.1	1.7	11.9	72.3	71.0	271	do	do	Slightly creamy	1.45	.69	2.10	6.44	.438	17.00	16.37	6.61	7.70	14.31	46.19	2.23
13770	61.9	4.0	10.6	74.0	71.1	268	do	do	Creamy	1.14	.43	1.55	6.59	.221	15.22	14.69	5.31	8.28	13.59	39.07	1.54
13571	61.0	1.6	11.5	71.0	69.8	274	do	do	White	.88	.59	2.10	6.49	.422	16.10	15.60	6.61	6.99	13.60	48.60	1.80
13464	59.1	1.5	10.6	68.8	67.8	280	do	do	do	.90	.51	2.10	6.55	.438	13.41	12.47	5.20	5.80	11.00	47.27	2.30
13598	60.4	1.0	11.9	70.1	69.4	278	do	do	do	1.16	.43	1.77	6.44	.304	16.60	16.02	6.43	7.87	14.30	44.97	1.87
13757	60.6	2.6	11.3	71.6	69.7	274	do	do	do	1.20	.44	1.51	6.52	.191	14.80	14.03	5.03	7.11	12.14	41.43	1.73
13688	55.7	3.0	11.5	67.3	65.3	293	do	do	Slightly creamy	1.17	.59	1.85	6.50	.403	16.16	15.41	5.93	7.32	13.25	44.76	1.95
13687	48.7	2.2	11.9	62.7	61.3	314	do	do	Creamy	1.51	.62	2.49	6.56	.513	15.85	15.22	6.18	6.93	13.11	47.14	1.91
13599	60.9	1.3	12.7	70.4	69.5	279	do	do	Slightly creamy	1.06	.45	1.89	6.50	.234	16.40	15.94	6.56	7.67	12.23	49.58	1.91
13767	60.0	3.2	10.6	70.8	68.6	276	do	do	White	1.05	.39	1.35	6.60	.220	15.30	14.37	5.13	7.28	12.41	41.39	1.57
13769	62.6	2.9	10.8	72.0	69.9	272	do	do	Slightly creamy	1.20	.43	1.49	6.60	.234	15.71	14.29	5.23	7.17	12.40	42.18	1.82
13604	60.3	1.6	12.2	71.6	70.5	274	do	do	Creamy	1.32	.61	1.77	6.48	.334	17.20	16.40	6.82	7.46	14.28	47.76	2.04
13601	60.9	1.9	11.7	72.2	70.8	271	do	do	Slightly creamy	1.25	.71	1.99	6.57	.428	17.96	17.35	6.89	8.17	15.06	45.75	1.97
Average	59.5	2.2	11.5	70.6	69.0	278	do	do	do	1.19	.53	1.86	6.52	.337	16.10	15.32	6.02	7.38	13.27	45.11	1.90
13779	60.8	3.8	9.9	72.7	69.9	269	Very hard	do	Very creamy	1.97	.62	1.38	6.69	.220	14.21	13.80	4.85	7.18	12.03	40.32	2.52
13616	60.4	1.8	11.9	71.9	70.6	273	do	do	do	1.86	.80	1.76	6.61	.313	15.76	15.41	5.66	7.74	13.40	42.24	2.59
13582	60.2	2.5	11.5	73.1	71.3	269	do	do	Creamy	1.26	.90	1.96	6.59	.389	16.31	15.87	6.02	7.62	13.64	44.14	2.72
13617	60.7	1.8	11.9	73.4	72.0	268	do	do	Very creamy	1.51	.78	1.73	6.67	.279	15.46	14.45	5.17	7.47	12.64	40.90	2.27
13783	60.7	3.2	11.7	73.6	71.3	269	do	do	Creamy	1.40	.67	1.38	6.73	.187	14.94	14.26	5.34	6.82	12.16	43.92	2.24
Average	60.6	2.6	11.4	72.9	71.0	270	do	do	do	1.60	.75	1.64	6.66	.278	15.34	14.76	5.41	7.37	12.78	42.30	2.47
13807	63.2	2.4	11.1	74.3	72.5	263	Hard	do	do	1.17	.44	1.50	6.61	1.99	15.76	15.10	5.77	7.57	13.34	43.25	1.82
13588	60.6	1.8	10.1	73.4	72.1	261	do	do	do	1.17	.50	1.80	6.71	.260	14.14	13.54	5.06	6.62	11.68	43.32	1.88
13625	60.0	1.7	11.9	72.5	71.2	270	do	do	White	1.45	.47	1.70	6.56	.260	14.90	14.39	5.56	6.98	12.54	44.34	1.64
13808	62.8	2.2	10.2	67.1	65.6	288	do	do	do	1.18	.37	1.48	6.34	.202	15.76	14.62	5.54	7.60	13.04	42.49	1.70
13587	61.2	1.7	11.7	72.9	71.6	268	do	do	do	1.20	.53	1.80	6.72	.256	14.86	14.21	5.09	7.22	12.13	41.96	1.69
13627	60.7	1.9	12.3	71.4	70.1	276	do	do	do	1.45	.47	1.70	6.49	.275	13.94	13.27	4.96	6.69	11.65	42.53	1.65
13692	58.8	3.2	10.9	68.6	68.2	274	do	do	do	1.42	.48	1.50	6.43	.188	13.98	13.26	4.88	6.52	11.40	42.81	2.09
13594	61.1	1.8	11.9	72.3	71.0	271	Semihard	do	do	1.02	.46	1.90	6.50	.227	16.19	15.69	5.86	8.12	13.98	41.92	1.92
13633	59.3	1.8	11.3	71.8	70.5	271	do	do	do	1.12	.48	1.69	6.54	.301	16.27	15.22	5.70	7.65	13.35	42.70	1.72

13695	56.8	6.8	10.6	72.1	69.2	274	Soft	do	do		1.15	.55	1.49	6.48	.299	15.00	14.36	5.23	7.22	12.45	42.01	1.97
13473	61.0	2.7	10.3	74.1	72.0	263	do	do	do		1.05	.54	1.78	6.56	.327	10.77	9.64	4.02	4.03	8.05	49.94	2.60
Average	58.9	3.1	11.1	71.0	69.3	275	do	do	do		1.18	.50	1.71	6.52	.273	13.11	12.76	4.91	6.15	11.06	44.93	2.08
13445	58.5	1.6	13.1	72.1	71.0	274	do	do	Slightly creamy		1.36	.56	1.63	6.46		12.97	12.02	4.52	5.87	10.39	43.50	2.05
13366	55.9	2.7	12.0	71.0	69.1	279	do	do	Creamy		1.62	.52	2.09	6.52	.365	19.91	19.53	7.33	9.88	17.21	42.59	1.71
13689	57.7	3.1	12.4	70.3	68.1	284	do	do	White		1.11	.51	1.51	6.53	.330	15.04	14.55	5.43	7.19	12.62	43.03	2.04
13465	61.0	1.4	11.2	71.9	70.9	269	do	do	do		1.60	.50	1.83	6.56	.378	10.75	9.76	3.93	4.44	8.37	46.97	2.05
13626	62.0	1.7	12.2	71.1	69.9	276	do	do	do		1.43	.46	1.68	6.56	.255	12.94	12.46	4.30	6.67	10.97	39.20	1.66
13802	62.5	2.3	10.4	72.8	71.1	266	do	do	do		1.27	.42	1.46	6.61	.264	15.26	14.63	5.39	7.65	13.04	41.34	1.93
13438	59.1	1.4	13.0	71.4	70.4	277	do	do	do		1.43	.57	1.74	6.53	.350	12.76	11.82	4.71	5.57	10.28	45.82	2.01
13442	61.4	1.0	13.2	71.5	70.8	276	do	do	Creamy		2.45	.46	1.50	6.49		13.26	12.00	4.77	5.69	10.46	45.60	2.03
13592	59.8	1.9	11.6	68.5	67.2	285	do	do	do		1.05	.44		6.52	.226	14.29	13.27	5.36	6.20	11.90	45.04	1.81
Average	60.4	1.9	11.8	71.5	70.1	274	do	do	Slightly creamy		1.40	.48	1.67	6.55	.278	14.44	13.68	5.18	6.79	11.97	43.40	1.84
14333	63.3	2.3	10.0	71.0	69.3	272	Soft	Soft	White		1.20	.40	1.50	6.51	.321	14.13	13.32	4.96	6.26	11.22	44.21	2.31
14349	63.0	2.2	10.7	71.6	70.0	271	do	do	do		1.18	.41	1.61	6.38	.350	13.26	12.15	4.15	6.12	10.27	40.41	2.25
13462	61.0	1.2	12.5	69.6	68.8	280	do	do	do		.92	.46	1.58	6.46	.266	13.23	11.84	4.61	5.66	10.27	44.89	2.16
13382	56.7	2.3	10.6	67.1	65.6	289	do	do	do		1.46	.48	1.90	6.40	.366	16.82	15.42	6.27	7.31	13.58	46.17	1.89
14338	63.7	2.2	10.4	73.5	71.9	263	do	do	do		1.25	.40	1.45	6.08	.390	10.99	9.05	3.89	4.50	8.39	46.36	2.38
13381	57.8	2.4	10.8	68.3	66.8	287	do	do	Slightly creamy		1.05	.43	1.93	6.54	.275	16.31	15.37	5.90	7.90	13.80	42.75	1.87
13460	58.9	.9	12.9	67.2	66.6	293	do	do	do		.97	.38	1.66	6.34	.188	12.68	11.50	4.53	5.56	10.09	44.90	2.18
13631	57.9	1.8	11.2	69.4	68.1	280	do	do	do		1.62	.56	1.84	6.50	.292	16.17	15.02	6.18	6.82	13.00	47.54	1.78
14342	61.6	2.1	9.8	70.9	70.4	267	do	do	do		1.47	.56	1.55	6.14	.390	14.62	13.58	5.39	6.15	11.54	46.71	2.19
Average	60.4	1.9	11.0	69.8	68.6	278	do	do	do		1.24	.45	1.67	6.37	.315	14.25	13.03	5.10	6.25	11.35	44.88	2.11
13469	56.2	2.1	10.7	70.8	69.3	274	do	do	White		1.14	.58	1.93	6.55	.256	9.82	9.00	3.61	3.79	7.40	48.78	2.40
13471	56.4	3.3	10.7	70.0	67.7	280	do	do	do		1.05	.48	1.89	6.60	.329	9.69	8.38	3.22	3.57	6.79	47.42	2.57
13693	55.9	4.8	11.8	69.6	66.2	290	do	do	do		1.33	.46	1.54	6.55	.236	15.38	14.57	6.00	6.76	12.76	47.02	1.87
13470	62.0	1.8	10.8	71.4	70.1	271	do	do	Slightly creamy		1.04	.50	1.71	6.54	.271	10.83	9.96	3.81	4.72	8.53	44.67	2.33
13593	61.0	1.5	11.9	71.4	70.3	274	Semihard	do	White		1.27	.43	1.70	6.48	.248	10.65	15.59	5.91	8.28	14.19	41.65	1.79
13632	59.4	4.4	11.3	69.3	68.2	280	Soft	do	do		1.35	.51	1.65	6.45	.321	15.58	14.75	5.77	6.96	12.73	45.33	1.65

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In table 16, pages 52 and 53, the three bottom lines on page 52 and the three top lines on page 53 should appear at the bottom of the table.

Stated in another way; samples with laboratory numbers 16,692, 16,694, 16,696, 16,695, 16,475 and the average line should all appear at the bottom of the table following sample 16,692. The average just mentioned is the average of the last group in the table.

TABLE 17.—*Wheats grown in the United States: Baking properties of the variety samples described in Tables 15 and 16*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13600	165	63	63.4	2,170	516	86	93	Excellent	Creamy	Light brown	Excellent	297
13573	172	54	66.9	2,130	529	68	89	Fair	Creamy, gray (smutty)	Brown	Good	305
13770	144	63	64.7	2,620	516	89	92	Excellent	Creamy, gray	do	Excellent	297
13571	159	58	61.4	2,240	513	88	91	Good	Light creamy	do	do	296
13464	142	63	60.1	2,210	509	88	92	Excellent	Creamy	do	Good	293
13598	174	64	61.1	2,320	509	89	92	do	do	do	Excellent	293
13757	144	65	59.9	2,310	510	92	94	do	Light creamy	do	do	294
13688	145	59	58.5	2,330	507	86	93	do	Creamy	do	do	292
13687	149	61	59.6	2,260	498	84	92	Good	do	Light brown	do	287
13509	168	65	59.3	2,260	507	86	91	do	Creamy, gray	Brown	Good	292
13767	151	59	60.2	2,060	513	87	88	Good, crumbly	do	do	do	296
13769	141	63	64.2	2,650	515	90	91	Excellent	do	do	Excellent	297
13604	158	60	61.6	2,210	504	88	92	Good	do	do	Good	291
13601	170	62	64.1	2,300	519	88	94	Excellent	Light creamy, gray	do	Excellent	291
Average	156	61	61.8	2,291	512	86	92	Very good	Creamy, gray	do	Very good	294
13779	144	58	62.7	1,980	517	84	89	Good	Very creamy	do	Fair	298
13616	147	58	63.3	2,000	522	81	90	Excellent	Creamy	Dark brown	do	301
13582	134	50	63.2	1,950	514	87	92	Good	do	Brown	do	296
13617	145	50	65.4	1,890	517	82	92	Excellent	do	Dark brown	Poor	298
13783	153	58	64.8	1,960	517	85	89	do	Very creamy	Brown	Fair	298
Average	145	55	63.9	1,956	517	84	90	Very good	Creamy	do	Good	298
13807	150	62	65.1	2,840	511	90	93	Excellent	Light creamy	do	do	295
13588	143	54	61.9	2,310	508	87	93	do	Creamy, gray	do	Excellent	293
13625	149	63	59.5	2,060	510	87	91	Good	Creamy	Light brown	Good	294
13808	153	62	64.6	2,800	516	91	91	Excellent	Light creamy	do	do	297
13587	143	51	63.2	2,380	509	86	92	do	Creamy	do	do	293
13627	150	62	58.9	2,060	505	88	92	Good	Light creamy, gray	do	Excellent	291
13445	151	57	57.5	1,870	504	87	89	do	Creamy, gray	Brown	Fair	291
13366	139	48	60.3	2,030	520	80	91	Good, crumbly	Very creamy			300
13689	145	60	63.3	1,930	519	80	78	Fair, crumbly	Creamy, gray	Brown	Poor	299
13465	138	62	60.3	2,100	509	87	94	Excellent	Creamy	do	Fair	293
13626	146	64	60.2	1,980	513	88	90	Fair	Light creamy, gray	Light brown	Good	296
13802	146	64	64.8	2,350	519	87	93	Good	do	do	Fair	299
13438	137	59	59.1	1,910	511	86	86	Fair, crumbly	Creamy, gray	do		295
13442	133	58	60.6	1,850	511	80	82	do	Very creamy	Brown		295
13592	165	59	60.2	2,640	504	88	93	Excellent	Creamy	do	Excellent	291
Average	146	59	61.3	2,207	511	86	90	Good	do	do	Good	295

14333	108	62	54.3	2,060	501	88	89	Fair	Creamy, gray	Light brown	do	289
14349	102	61	54.6	2,240	493	88	91	Good	Creamy	do	do	284
13462	113	58	55.5	2,130	504	88	92	Good, crumbly	do	Brown	Fair	291
13382	112	51	58.6	2,010	508	85	86	do	do			293
14338	115	79	52.2	2,050	490	88	86	Fair, crumbly	do	Light brown	Fair	282
13381	111	54	59.1	2,130	502	86	90	Good	Light creamy			289
13460	122	58	54.1	2,210	495	89	93	Excellent	Creamy	Brown	Fair	285
13631	123	57	55.3	2,330	494	84	91	Good, crumbly	do	Light brown	Good	285
14342	106	59	54.9	2,050	499	85	88	Good	do	do	Fair	288
Average	112	60	55.4	2,134	498	87	90	do	do	do	do	287
13469	117	58	52.9	1,850	492	86	86	Fair, crumbly	Creamy, gray	do	do	284
13471	111	61	53.6	1,870	491	84	90	do	Very creamy	Brown	do	283
13693	129	60	58.0	2,230	501	86	92	Good	Creamy	do	Good	289
13470	115	59	60.4	1,930	514	88	91	do	Light creamy, gray	do	Fair	296
13593	137	60	62.7	2,160	515	87	93	do	Creamy	do	Good	297
13632	116	59	59.6	2,190	504	87	91	do	Light creamy	Light brown	do	291
12692	133	64	61.3	2,160	516	88	91	do		Brown	Fair	297
13594	136	61	63.3	2,590	516	91	93	Excellent	Light creamy	do	Good	297
13633	112	58	58.6	2,620	495	92	93	do	Very light creamy	Light brown	Fair	285
13695	126	55	59.9	2,050	515	87	88	Fair, crumbly	Creamy	Brown	Good	297
13473	115	57	59.4	1,910	516	88	91	Excellent	Light creamy	do	Fair	297
Average	122	59	59.1	2,142	507	88	91	Good	do	do	do	292

Considering the hard red spring wheats first, it is apparent (Table 16) that there are some differences in the milling qualities of the four varieties of spring wheat selected. On the basis of the milling quality of the weight of wheat necessary to produce a barrel of flour, Kota ranked first, Ruby second, Power third, and Marquis fourth. However, on account of its creamy color, the flour milled from Kota would probably not be as acceptable as that produced from the other three varieties.

From a baking standpoint all the flours milled from the spring wheat varieties exhibited excellent strength. The water absorption of the flour was high and fermentation tolerance was excellent, as were all the other factors entering into the scoring of a good loaf of bread. Moreover, the quantity of bread that could be baked from a barrel of flour by the method of baking used was high.

The milling quality of the five durum varieties was likewise good because high test weight per bushel and high flour yield went hand in hand to make possible the production of a barrel of flour with the average quantity of wheat necessary to accomplish this purpose.

From a baking standpoint, due consideration being given to the fact that durum wheat flour is not extensively used for bread making, the strength of the durum flour was good. But the durum flour did not have the baking strength of the spring wheat flour, for weakness was apparent, particularly in the texture of the crumb and the break and shred of the loaf.

The hard red winter wheat varieties showed a greater variation in milling properties than did either the hard red spring or the durum wheat varieties. The test weight per bushel varied from 54.3 to 62 pounds. The flour yield varied from 65.6 to 72.5 per cent. Ranked in the order of their milling properties, Kanred was first, and Turkey and Kharkof followed closely.

The baking quality of the hard winter wheat varieties was variable mostly with regard to volume of loaf and color of crumb. As far as water absorption of the flour, fermentation time of the dough, and texture of the loaf are concerned, average to above average conditions prevailed with but one or two exceptions. Bread production was high, averaging 295 pound loaves per barrel of flour. On the average, a slightly better loaf of bread was obtained from the spring-wheat flours than from the winter-wheat flours.

The milling properties of the soft red winter samples showed some variation. Flour yield from the samples of this class of wheat was somewhat below average; it would take more wheat of any one of these varieties to produce a barrel of flour than is the case with the hard red winter varieties.

The quality of the bread baked from the soft red winter wheat flours was not equal to that made from the flours milled from the hard red spring and hard red winter wheat varieties. The difference was largely in the size and weight of the loaf. Partly because of the low average water absorption of the soft red winter wheat flour, a lightweight loaf resulted. This precludes the possibility of making a large number of 1-pound loaves of bread from a barrel of flour.

From a milling standpoint, the quality of the white wheat varieties tested was variable. Test weight per bushel varied from 54.1 pounds to 60.7 pounds. Flour yields, dockage-free basis, varied from 66.2 to 72 per cent. As a result, milling quality expressed as the quantity of

wheat necessary to produce a barrel of flour varied from 263 to 290 pounds. Of the five varieties tested, Quality appeared to have outstanding merit.

The flour milled from the white wheats produced good bread, somewhat inferior to that made from the spring wheat and hard winter wheat flours, but slightly superior both from a quality and a quantity standpoint, to the bread made from the soft winter wheat flours.

MILLING AND BAKING QUALITIES OF UNITED STATES EXPORT WHEAT

Wheat and wheat flour constitute a very important part of the international trade of the United States, as the United States stands second in the exportation of wheat, Canada holding first place. In value of crops exported, wheat stands second only to cotton. Exports of wheat for the period 1920–1928, by commercial classes are given in Table 18.

TABLE 18.—*Wheat, excluding flour: Exports from the United States by classes, 1920–1928*

Year beginning July	Hard red winter	Hard red spring	Durum	Soft red winter	White	Total
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
1920	162,544	18,421	31,037	59,296	21,070	293,368
1921	90,651	25,613	25,645	29,274	28,138	208,321
1922	61,165	13,975	43,188	22,770	13,853	154,951
1923	26,984	2,068	18,836	10,464	20,441	78,793
1924	120,578	21,567	33,811	8,383	11,201	195,490
1925	9,677	4,068	26,834	2,563	19,157	63,189
1926	73,123	2,174	21,970	31,352	27,631	156,250
1927	65,184	6,146	30,946	13,452	30,271	145,999
1928 [1]	30,530	1,248	29,830	1,733	9,416	103,114

Based upon reports to the Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics, to the Bureau of Foreign and Domestic Commerce, and studies of the Bureau of Plant Industry.

[1] Six months, July–December.

Durum wheat, hard winter wheat, and white wheat constitute the bulk of the export wheats of the United States. Exports of soft red winter wheats have declined with the decrease in production.

To learn about the milling and baking properties of the United States export wheats, a large number of cargo samples were secured abroad through the courtesy of the Superintendence Co. These were subjected to the milling and baking tests previously described. Results are given in Tables 19, 20, and 21.

TABLE 19.—*United States export wheats: Ports and dates of loading and unloading, and description and characteristics of samples taken at port of unloading*

Laboratory No.	Port of loading	Date of loading	Port of unloading	Date of unloading	Predominating class	Trade designation	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
								P. ct.	*P. ct.*	*Pounds*	*P. ct.*	*P. ct.*
13392	New York	Mar., 1926	Rotterdam, Holland	Apr., 1926	Hard red spring	1 Dark Northern Spring.	2 Dark Northern Spring	0.8	80.9	60.2	2.4	1.1
14157	Baltimore	Dec., 1926	Hamburg, Germany	Dec., 1926	Durum	2 Amber Durum	3 Durum	.5	58.6	61.0	4.4	1.2
13562	Montreal	June, 1926	Avonmouth, England.	June, 1926	do	do	2 Amber Durum	1.0	75.1	61.3	.0	1.9
14087	do	Nov., 1926	Hamburg, Germany	Nov., 1926	do	do	3 Durum	.7	53.6	61.3	4.6	1.1
14294	do	Dec., 1926	Avonmouth, England.	Dec., 1926	do	do	do	.8	53.6	61.0	4.8	1.6
14086	New York	Nov., 1926	Hamburg, Germany	Nov., 1926	do	do	2 Amber Durum	.2	75.6	62.1	1.3	1.2
14158	do	Dec., 1926	do	Dec., 1926	do	do	do	.9	75.3	61.2	1.8	1.7
13488	Philadelphia	Mar., 1926	Rotterdam, Holland	Apr., 1926	do	do	do	2.3	75.1	60.4	.4	2.0
13561	Montreal	May, 1926	Hull, England	June, 1926	do	2 Mixed Durum	4 Mixed (durum, 82.9 per cent; hard red spring, 16.8 per cent; white, 0.3 per cent).	4.0		60.8	.3	3.5
13731	do	July, 1926	Avonmouth, England.	July, 1926	do	do	3 Mixed Durum	2.8		61.3	.9	2.4
13926	do	Sept., 1926	London, England	Oct., 1926	do	do	do	3.4		60.9	1.7	2.4
14293	do	Nov., 1926	Hull, England	Dec., 1926	do	do	3 Red Durum	3.0		61.0	5.4	1.7
	Average							1.8	66.7	61.1	2.3	1.9
13684	New York	Aug., 1926	Copenhagen, Denmark.	Sept., 1926	Hard red winter	1 Hard Winter	1 Hard Winter	.5	54.6	62.8	.6	.3
13909	do	do	Hamburg, Germany	Aug., 1926	do	do	do	.5	60.8	61.4	.6	.6
13910	Port Arthur	do	do	do	do	do	do	1.4	58.4	60.7	.8	.6
14259	San Francisco	Dec., 1926	Randers, Denmark	Feb., 1927	do	do	1 Dark Hard Winter	1.0	81.6	61.6	.1	.5
13730	Galveston	July, 1926	Avonmouth, England.	Aug., 1926	do	2 Hard Winter	2 Hard Winter	1.4	57.4	61.1	.2	1.1
13755	do	do	Hamburg, Germany	do	do	do	do	1.3	52.5	60.9	.6	1.5
13911	do	Aug., 1926	do	Sept., 1926	do	do	do	.8	67.2	60.4	.5	2.0
14092	do	Oct., 1926	do	Nov., 1926	do	do	do	.7	53.0	59.2	.2	2.0
13912	Houston	Aug., 1926	do	Sept., 1926	do	do	do	1.2	60.4	60.8	.6	1.9
13914	Montreal	Sept., 1926	do	do	do	do	do	.8	34.4	60.0	1.4	.5
13927	do	do	London, England	Oct., 1926	do	do	do	.7	57.5	59.4	3.0	1.0
14035	do	do	Avonmouth, England.	do	do	do	do	.9	41.8	59.7	3.3	.6
13756	New Orleans	July, 1926	Hamburg, Germany	Aug., 1926	do	do	4 Hard Winter	1.2	63.2	59.6	.4	3.9
14159	do	Dec., 1926	do	Jan., 1927	do	do	2 Hard Winter	1.2	41.2	59.6	2.3	1.2
13685	New York	Aug., 1926	Copengahen, Denmark.	Sept., 1926	do	do	do	1.1	49.4	59.8	.7	.5

13915	---do---	---do---	Hamburg, Germany	---do---	---do---	---do---	---do---	.9	40.8	59.7	2.8	.9
13940	---do---	Sept., 1926	Copenhagen, Denmark.	---do---	---do---	---do---	---do---	1.0	61.0	61.4	2.9	1.7
13941	---do---	Oct., 1926	---do---	Oct., 1926	---do---	---do---	4 Hard Winter	1.1	39.8	60.2	2.0	3.9
14009	---do---	---do---	Dunkirk, France	---do---	---do---	---do---	2 Hard Winter	.8	62.0	59.8	1.5	.6
14011	---do---	---do---	---do---	---do---	---do---	---do---	---do---	.7	34.6	59.9	1.4	1.0
14017	---do---	---do---	---do---	---do---	---do---	---do---	---do---	.5	42.8	60.3	1.4	.5
13913	Port Arthur	---do---	Hamburg, Germany	Sept., 1926	---do---	---do---	---do---	.4	66.9	59.5	.3	.5
13729	Portland, Oreg.	July, 1926	Avonmouth, England.	July, 1926	---do---	---do---	---do---	1.0	73.0	60.3	.0	.3
14033	---do---	Aug., 1926	Hull, England	Oct., 1926	---do---	---do---	---do---	.5	69.4	60.9	.2	.6
14030	---do---	Oct., 1926	Hamburg, Germany	Dec., 1926	---do---	---do---	2 Hard Winter, smutty	2.8	80.5	58.9	.4	.9
14091	---do---	---do---	---do---	Nov., 1926	---do---	---do---	2 Hard Winter	.9	80.5	61.2	.0	.4
14255	San Francisco.	Dec., 1926	Randers, Denmark	Feb., 1927	---do---	---do---	1 Dark Hard Winter (scoured).	1.0	83.4	60.8	.0	.4
13549	(1)	Aug., 1926	Bremen, Germany	Aug., 1926	---do---	---do---	3 Hard Winter	1.2	67.4	59.3	.4	2.9
13550	(1)	---do---	---do---	---do---	---do---	---do---	2 Hard Winter	2.2	66.4	59.1	.3	2.0
13551	(1)	---do---	---do---	---do---	---do---	---do---	1 Hard Winter	.4	69.6	60.4	.1	.9
13737	(1)	Sept., 1926	---do---	Sept., 1926	---do---		3 Hard Winter	.9	63.0	60.1	.8	2.2
13738	(1)	---do---	---do---	---do---	---do---	---do---	2 Hard Winter	2.2	47.1	58.7	.9	1.2
13742		---do---	---do---	---do---	---do---	---do---	---do---	1.2	49.6	59.6	.5	.9
	Average							1.0	58.5	60.2	.9	1.2
13916	New York	Aug., 1926	Hamburg, Germany	Sept., 1926	Soft red winter	1 Red Winter	2 Red Winter	.4		60.3	2.6	.3
13928	---do---	Sept., 1926	London, England	Oct., 1926	---do---	---do---	1 Red Winter	.2		61.4	1.0	.3
14038	Baltimore	Aug., 1926	Hull, England	Sept., 1926	---do---	2 Red Winter	2 Red Winter	.5		59.3	3.9	.5
13917	---do---	Sept., 1926	Hamburg, Germany	---do---	---do---	---do---	1 Red Winter	.3		60.5	2.0	.4
14296	---do---	Dec., 1926	Avonmouth, England.	Jan., 1927	---do---	---do---	2 Red Winter	.5		59.8	3.9	.5
14297	---do---	Jan., 1927	Liverpool, England	Feb., 1927	---do---	---do---	---do---	.4		60.2	3.0	1.4
14479	---do---	Feb., 1927	Avonmouth, England.	Mar., 1927	---do---	---do---	---do---	.7		59.9	3.1	.3
14480	---do---	Mar., 1927	---do---	Apr., 1927	---do---	---do---	1 Red Winter	.6		60.2	1.9	1.0
13918	New York	Sept., 1926	Hamburg, Germany	Sept., 1926	---do---	---do---	3 Red Winter	.5		59.6	4.8	.2
13929	---do---	---do---	London, England	Oct., 1926	---do---	---do---	2 Red Winter	.3		59.4	1.7	.7
14005	---do---	Oct., 1926	Dunkirk, France	Nov., 1926	---do---	---do---	---do---	.4		58.2	3.7	.5
14012	---do---	---do---	---do---	---do---	---do---	---do---	---do---	.4		60.0	2.1	.6
14013	---do---	---do---	---do---	---do---	---do---	---do---	3 Red Winter	.6		59.0	4.5	.9
13907	Savannah, Ga.	Sept., 1926	Hamburg, Germany	Oct., 1926	---do---	---do---	2 Red Winter	.3		59.4	3.6	.5
13741	(1)	---do---	Bremen, Germany	Sept., 1926	---do---	---do---	---do---	.3		59.6	1.6	.4
13739	(1)	---do---	---do---	---do---	---do---	---do---	---do---	.4		59.1	3.6	.4
13740	(1)	---do---	---do---	---do---	---do---	---do---	---do---	.5		60.4	3.2	1.2
13930	Baltimore	July, 1926	Hull, England	---do---	---do---	2 Red Winter, garlicky	2 Red Winter, garlicky	.4		59.0	.8	1.0
14037	---do---	Aug., 1926	---do---	---do---	---do---	---do---	---do---	.5		58.7	2.0	.8
14095	---do---	Oct., 1926	Hamburg, Germany	Nov., 1926	---do---	---do---	---do---	.5		59.7	2.9	.3
13908	Savannah	Sept., 1926	---do---	Oct., 1926	---do---	---do---	2 Red Winter	.6		58.8	2.6	.1
14093	Portland, Oreg.	---do---	---do---	---do---	---do---	2 Red Western	2 Red Western	.6		61.4	.2	.5
14094	---do---	Oct., 1926	---do---	Nov., 1926	---do---	---do---	2 Red Western (washed)	.4		59.8	.1	.3
	Average							.4		59.7	2.6	.6

[1] Port of loading not known.

TABLE 19.—*United States export wheats: Ports and dates of loading and unloading, and description and characteristics of samples taken at port of unloading*—Continued

Laboratory No.	Port of loading	Date of loading	Port of unloading	Date of unloading	Predominating class	Trade designation	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
								P. ct.	*P. ct.*	*Pounds*	*P. ct.*	*P. ct.*
14302	Tampa, Fla.	Jan., 1927	Hull, England	Feb., 1927	White	Hard White	2 Hard White	1.0	87.2	59.5	0.0	0.1
14303	do	do	do	do	do	Hard Federation	1 Hard White	1.3	94.4	61.5	.1	1.0
13733	Portland, Oreg.	May, 1926	Avonmouth, England.	July, 1926	do	do	2 Hard White	.9	97.0	59.9	.1	.5
13932	do	Aug., 1926	Hull, England	Sept., 1926	do	do	1 Hard White	1.0	92.7	60.2	.1	.4
14461	Vancouver	Jan., 1927	do	Mar., 1927	do	do	2 Hard White	1.8	94.0	58.6	.1	.2
13565	Portland, Oreg.	June, 1926	Liverpool, England	July, 1926	do	Steel Hard White	do	.8	75.4	58.3	.0	.2
13732	do	do	Avonmouth, England.	Aug., 1926	do	Pacific wheat (steel)	do	.9	84.8	58.4	.1	.2
13931	do	July, 1926	Hull, England	Sept., 1926	do	Pacific wheat	do	1.0	83.4	59.0	.0	.0
13933	do	do	do	do	do	2 Soft White	2 Soft White	1.3	56.5	59.3	1.0	.1
14040	do	Oct., 1926	Liverpool, England	Nov., 1926	do	do	do	2.1	59.5	60.1	.0	.1
14060	San Francisco	Sept., 1926	do	Oct., 1926	do	do	1 Soft White (washed and scoured).	1.0	58.0	60.1	1.0	.2
14041	Portland, Oreg.	do	Cardiff, Wales	do	do	2 Western White	2 Western White	2.1	.....	59.2	.5	.5
14042	do	do	do	do	do	do	do	2.2	.....	59.5	.2	.4
14301	do	Dec., 1926	Avonmouth, England.	Dec., 1926	do	Sample Wheat (North)	do	1.2	.....	59.0	.4	.3
13556	Baltimore	June, 1926	Hull, England	July, 1926	do	2 Mixed	1 Mixed (white, 74.3 per cent; soft red winter, 25.7 per cent).	.6	.....	60.5	1.6	.8
13557	New York	May, 1926	do	June, 1926	do	do	2 Mixed (white, 78.1 per cent; soft red winter, 21.2 per cent).	.6	.....	59.2	1.3	.6
	Average							1.2	80.3	59.5	.4	.4

TABLE 20.—*United States export wheats: Milling properties of the samples described in Table 19, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Foreign material in wheat as milled	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
					Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*					*Per cent*			*Per cent*	*Per cent*	
13392	59.4	2.3	0.3	13.1	71.3	69.6	280	Hard	Granular	Slightly creamy	0.98	0.47	6.40	0.284	12.58	12.18	2.18
14157	60.9	2.2	1.1	11.8	70.6	69.4	277	Very hard	do	Creamy	2.06	.57	6.62	.242	12.22	10.83	2.21
13562	60.8	3.5	1.5	13.4	74.3	72.4	270	do	do	do	1.37	.72	6.46	.282	11.72	10.92	2.84
14087	61.2	3.1	.6	12.3	73.5	71.7	270	do	do	do	1.75	.67	6.69	.306	12.03	11.49	2.23
14294	61.3	4.5	.7	11.2	73.4	70.7	270	do	do	Slightly creamy	1.52	.66	6.53	.359	12.12	11.54	2.40
14086	61.6	2.9	.4	11.9	74.5	72.5	266	do	do	Creamy	1.54	.69	6.69	.295	13.14	12.28	2.72
14158	60.7	3.0	.9	11.7	71.8	70.2	273	do	do	do	1.82	.65	6.68	.238	12.72	11.80	2.33
13488	60.3	3.9	1.3	13.6	72.2	70.9	277	do	do	do	1.32	.71	6.47	.274	11.84	11.37	2.75
13561	61.7	5.8	1.7	12.5	71.4	70.0	277	do	do	do	1.36	.68	6.43	.272	11.04	10.04	2.48
13731	61.1	4.7	1.7	11.3	70.1	68.7	278	do	do	do	1.89	.65	6.36	.266	10.98	10.35	2.50
13926	61.1	6.0	1.6	11.2	69.8	68.8	277	do	do	Slightly creamy	1.20	.72	6.38	.312	11.42	11.16	2.76
14293	61.1	5.2	1.2	11.6	70.9	69.3	277	do	do	do	1.45	.65	6.50	.345	12.98	12.21	2.35
Average	61.1	4.1	1.2	12.0	72.0	70.4	274	do	do	Creamy	1.57	.67	6.53	.290	12.02	11.27	2.51
13684	63.7	1.9	.1	11.1	74.4	73.3	260	Hard	do	Slightly creamy	1.28	.52	6.40	.284	10.03	9.31	1.92
13909	62.1	2.6	.2	10.3	72.1	70.6	268	do	do	White	1.57	.53	6.32	.342	11.08	10.07	2.06
13910	62.0	3.9	.5	10.2	72.5	70.7	268	do	do	do	1.25	.45	6.38	.324	11.09	10.15	2.50
14259	62.3	3.5	.0	10.3	73.2	71.3	265	do	do	do	1.03	.54	6.52	.320	10.31	9.82	2.41
13730	62.2	2.8	.5	11.6	72.7	71.6	268	do	do	do	1.57	.50	6.35	.293	10.94	10.02	2.34
13755	62.3	3.7	.8	11.2	72.7	71.0	269	Semihard	do	do	1.59	.48	6.26	.331	11.03	10.23	2.07
13911	61.7	3.9	1.6	10.2	73.3	71.5	264	Hard	do	do	1.48	.52	6.39	.303	10.83	10.70	2.66
14092	60.6	3.0	.8	11.7	74.1	72.4	265	do	do	Slightly creamy	1.05	.60	6.73	.250	11.25	10.52	2.47
13912	62.1	3.7	1.5	10.8	72.0	70.1	271	do	do	White	1.42	.47	6.12	.364	10.85	9.97	2.75
13914	61.1	3.1	.1	10.4	71.5	69.9	271	do	do	Slightly creamy	1.59	.50	6.24	.324	10.43	9.53	1.76
13927	60.2	2.7	.5	10.9	70.2	68.8	277	do	do	White	.98	.48	6.39	.252	10.63	9.56	1.92
14035	60.6	2.5	.3	12.1	70.6	69.5	277	do	do	do	1.46	.54	6.49	.280	10.84	9.87	1.89
13756	61.2	4.2	3.3	11.5	71.1	68.9	278	do	do	do	1.84	.47	6.26	.346	11.77	10.84	2.24
14159	60.2	3.9	.8	11.2	70.6	68.7	278	do	do	do	1.83	.46	6.52	.266	10.35	9.30	2.19
13685	61.3	3.1	.2	11.1	72.8	71.3	267	do	do	Slightly creamy	1.25	.58	6.46	.316	10.73	9.93	2.25
13915	62.0	3.4	.4	10.4	71.7	69.9	271	do	do	White	1.69	.49	6.27	.328	10.34	9.49	1.93
13940	62.8	2.7	1.3	10.3	69.5	68.3	277	do	do	do	1.28	.51	6.53	.367	10.70	10.01	1.93
13941	61.2	3.5	3.0	10.3	69.5	67.8	279	do	do	do	1.20	.48	6.44	.309	10.49	9.60	2.22

TABLE 20.—*United States export wheats: Milling properties of the samples described in Table 19, and certain chemical constituents of the wheats and of the flour made from them*—Continued

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Foreign material in wheat as milled	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
					Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*					*Per cent*		*Per cent*	*Per cent*	*Per cent*	
14009	60.9	3.2	.4	9.7	70.7	69.0	272	Hard	Granular	White	1.87	.50	6.39	.249	10.62	9.71	2.19
14011	61.0	3.2	.1	9.9	70.1	68.4	275	do	do	do	1.71	.49	6.64	.254	10.64	9.46	2.21
14017	61.0	2.5	.3	10.4	72.0	70.6	268	do	do	do	1.66	.54	6.70	.280	9.95	9.72	2.02
13913	60.7	3.6	.2	10.5	72.4	70.1	270	do	do	do	1.52	.51	6.41	.343	10.83	10.34	2.20
13729	60.8	3.2	.0	10.9	70.3	68.7	277	do	do	do	1.26	.48	6.37	.291	10.16	9.48	2.37
14033	61.9	2.5	.2	11.3	70.4	69.0	277	do	do	do	1.49	.54	6.62	.288	9.74	9.05	2.32
14090	61.3	6.8	.1	10.3	69.8	68.0	278	do	do	Slightly creamy	1.40	.58	6.62	.289	10.01	9.45	2.16
14091	61.5	3.5	.0	10.9	72.2	70.3	271	do	do	White	1.49	.54	6.69	.252	10.54	9.55	2.32
14255	61.5	3.6	.0	10.2	69.9	68.0	278	do	do	do	1.18	.47	6.60	.313	10.52	9.83	2.55
13549[1]	60.1	3.1	2.7	13.4	73.1	71.7	273	do	do	do	1.18	.52	6.54	.257	11.78	11.38	2.49
13550	60.2	4.5	1.4	12.7	71.3	69.6	279	do	do	do	1.32	.55	6.57	.298	12.50	11.62	2.66
13551	61.1	2.9	.8	12.5	74.0	72.7	267	do	do	do	1.02	.50	6.61	.246	12.47	11.56	2.00
13737	61.5	2.9	1.6	10.8	72.2	70.7	267	do	do	Slightly creamy	1.14	.52	6.36	.291	11.06	9.76	2.40
13738	60.2	4.6	.8	11.2	72.6	70.8	269	do	do	do	1.32	.52	6.31	.350	11.26	10.65	2.03
13742	60.8	3.1	.6	11.3	73.4	72.0	265	do	do	do	1.15	.56	6.31	.297	11.43	10.73	2.30
Average	61.3	3.4	.8	11.0	71.8	70.2	271	do	do	White	1.40	.51	6.45	.300	10.82	10.04	2.23
13916	60.5	3.1	.1	10.7	70.4	68.5	276	do	do	do	1.37	.45	6.43	.348	10.82	9.43	1.95
13928	61.6	2.6	.1	11.5	70.6	68.9	278	do	do	do	1.40	.46	6.25	.356	10.15	9.39	1.90
14038	60.0	2.2	.5	11.6	70.6	69.4	276	do	do	do	1.36	.54	6.50	.308	10.54	9.52	2.13
13917	60.8	3.1	.1	10.2	69.3	67.3	281	do	do	do	.78	.43	6.26	.380	10.24	9.28	2.05
14296	60.3	2.4	.1	11.5	69.3	68.0	281	do	do	do	1.29	.41	6.42	.440	10.53	9.37	2.08
14297	60.6	2.4	.1	12.0	69.3	67.9	284	do	do	do	1.25	.47	6.31	.432	10.44	9.53	2.18
14479	59.9	2.2	.2	12.5	71.8	70.6	274	do	do	do	.99	.49	6.64	.335	10.32	9.01	2.09
14480	60.4	2.4	.3	12.5	70.8	69.5	279	do	do	do	1.13	.46	6.51	.334	10.07	9.04	2.12
13918	60.3	3.6	.2	10.4	69.8	67.6	280	do	do	do	1.40	.45	6.36	.356	10.26	9.37	1.90
13929	59.8	2.6	.2	11.8	70.6	68.9	279	do	do	do	.82	.45	6.25	.333	9.97	8.94	2.17
14005	59.1	3.7	.5	9.5	69.9	67.6	277	do	do	do	1.13	.47	6.45	.306	10.06	8.95	2.13
14012	60.4	3.5	.4	9.9	70.8	68.6	274	do	do	do	1.22	.46	6.51	.274	10.64	9.21	1.76
14013	59.4	3.8	.2	9.8	69.9	67.7	278	do	do	do	1.23	.44	6.49	.230	10.26	9.04	2.16
13907	59.8	4.1	.1	10.2	68.9	67.9	278	do	do	do	1.37	.44	6.36	.342	10.39	9.00	2.05
13741	60.2	2.1	.0	11.5	70.7	69.4	276	do	do	do	1.18	.50	6.28	.356	9.93	9.16	2.12
13739	60.1	2.2	.2	11.2	71.0	69.7	274	do	do	do	1.25	.55	6.39	.350	9.89	9.19	1.84

13740	61.0	2.4	.6	11.3	71.5	70.1	273	do	do	do	1.20	.50	6.33	.336	10.21	9.21	1.98
13930 [1]	59.0	5.0	.1	10.5	70.6	69.4	273	do	do	do	.92	.43	6.30	.295	9.21	8.49	2.23
14037 [2]	59.2	3.3	.3	11.8	71.7	69.7	276	do	do	do	1.49	.48	6.54	.294	9.48	8.59	2.18
14095 [1]	60.1	3.2	.3	11.4	73.7	71.9	266	do	do	do	1.07	.52	6.12	.249	9.82	9.10	2.12
13908 [1]	58.2	5.8	.2	10.2	69.0	67.5	274	do	do	do	1.24	.49	6.26	.338	11.77	10.76	2.32
14093	61.9	3.1	.0	10.4	71.8	69.9	271	Semihard	do	Slightly creamy	1.20	.56	6.71	.270	9.52	8.84	2.13
14094	60.4	3.5	.1	10.3	72.0	69.7	271	Soft	Soft	White	1.21	.49	6.64	.241	10.47	9.82	2.21
Average	60.1	3.1	.2	11.0	70.6	68.9	276	do	do	do	1.20	.48	6.40	.326	10.22	9.23	2.08
14302	61.0	3.7	.0	10.9	69.0	67.1	284	do	do	do	1.11	.51	6.50	.250	11.72	10.36	2.10
14303	61.9	3.0	.5	11.2	71.3	70.0	272	do	do	do	1.18	.50	6.47	.356	11.77	10.76	2.26
13733	60.1	2.5	.1	10.9	69.9	68.7	277	Semihard	do	do	1.30	.54	6.32	.301	12.52	11.21	2.31
13932	60.3	3.3	.0	11.0	69.3	67.7	281	Soft	do	do	1.04	.50	6.38	.291	11.31	10.82	2.43
14461	59.7	2.9	.1	11.0	69.4	68.6	278	Semihard	do	do	1.17	.51	6.60	.242	12.22	11.36	2.49
13565	58.4	3.6	.0	11.5	67.9	68.0	282	Soft	do	do	.96	.52	6.48	.369	12.23	10.65	2.27
13732	58.7	3.1	.0	10.3	66.6	67.5	280	do	do	do	1.28	.51	6.39	.294	12.74	11.58	2.00
13931	58.9	4.2	.0	10.3	68.0	68.1	278	do	do	do	.78	.51	6.40	.323	12.37	11.43	1.88
13933	58.4	5.2	.0	10.8	70.0	67.4	282	do	do	do	.76	.44	6.41	.329	9.77	8.62	2.32
14040	60.6	4.3	.0	10.7	69.0	67.5	281	do	do	do	1.40	.48	6.63	.250	9.68	8.60	2.16
14060	59.9	4.1	.1	12.5	70.7	68.5	275	do	Very soft	do	1.36	.51	6.67	.283	10.78	9.10	2.27
14041	59.6	5.0	.0	10.7	69.5	67.4	282	do	Soft	do	1.30	.48	6.63	.315	9.22	8.00	2.31
14042	59.7	4.6	.0	10.9	70.7	68.9	283	do	do	do	1.76	.49	6.68	.272	9.39	8.47	2.25
14301	59.3	4.5	.0	10.8	70.0	67.6	281	do	do	do	1.50	.50	6.51	.376	10.95	10.21	2.48
13556	60.4	3.9	.1	12.6	70.8	68.5	283	Semihard	do	do	1.26	.48	6.49	.320	9.98	8.79	2.27
13557	59.6	2.6	.5	13.8	70.4	68.9	285	Soft	do	do	1.19	.48	6.57	.313	9.38	8.29	2.33
Average	59.8	3.8	.1	11.2	69.5	68.2	280	do	do	do	1.21	.50	6.51	.305	11.00	9.89	2.26

[1] Odor of damaged wheat present in flour.

[2] Garlic odor in flour.

TABLE 21.—*United States export wheats: Baking properties of the samples described in Tables 19 and 20*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13392	131	61	59.0	2,240	512	88	93	Good	Light creamy, gray			295
14157	138	68	59.3	2,210	505	82	84	Excellent	Very creamy	Brown	Fair	291
13562	149	57	60.9	1,840	517	85	91	do	do	do	do	296
14087	131	65	59.2	2,020	509	83	88	Good	do	do	Poor	293
14294	130	64	59.2	2,060	506	84	87	do	do	do	Fair	291
14086	129	66	59.4	2,140	502	84	90	Excellent	do	do	Poor	289
14158	140	68	59.1	2,140	509	82	91	do	do	do	do	293
13488	122	58	66.2	1,950	529	87	92	do	Light creamy			305
13561	147	57	61.0	1,840	517	82	89	Good	Very creamy	Brown	Fair	298
13731	132	63	62.4	2,030	518	86	89	Fair	Creamy	do	Poor	299
13926	149	68	61.4	1,950	510	82	90	Good	Very creamy	do	do	294
14203	130	64	59.3	2,140	508	82	88	Excellent	do	do	Fair	293
Average	136	63	60.7	2,029	512	84	89	Very good	do	do	Unsatisfactory	295
13684	139	59	59.4	2,010	504	88	92	Good	Creamy	do	Poor	291
13909	140	65	59.3	2,100	503	88	91	do	do	Light brown	Fair	290
13910	142	61	57.9	2,060	503	91	92	do	Light creamy	do	Poor	290
14259	137	66	60.0	2,010	511	86	90	do	Creamy	Brown	do	295
13730	130	62	58.2	2,040	502	89	82	Poor, crumbly	Light creamy	Light brown	Fair	289
13755	135	65	58.6	2,110	503	89	90	Fair, crumbly	Creamy	do	do	290
13911	144	60	59.0	2,110	506	91	92	Good	Light creamy	Brown	do	291
14092	135	62	60.0	2,110	509	82	90	do	Creamy	do	do	293
13912	146	60	58.3	2,040	499	89	91	Fair	Light creamy	do	do	288
13914	150	68	57.3	2,190	499	89	92	Good	do	do	Good	288
13927	142	71	58.3	2,170	501	86	92	do	Creamy	Light brown	Fair	289
14035	132	65	57.4	2,290	502	84	91	do	do	Brown	do	289
13756	140	63	57.0	2,160	501	88	88	Fair, crumbly	do	Light brown	do	289
14159	147	68	55.4	2,380	499	86	92	Excellent	do	Brown	Poor	288
13685	145	64	61.1	2,170	509	87	91	Good	do	Light brown	Fair	293
13915	147	62	56.3	2,080	498	90	91	Fair, crumbly	Light creamy	do	Poor	287
13940	139	66	57.2	2,080	495	85	92	do	Creamy	Brown	Fair	285
13941	128	63	55.4	2,140	494	85	91	do	do	Pale	do	285
14009	134	63	55.5	2,240	500	85	92	Good	do	Light brown	do	288
14011	130	67	55.9	2,260	493	86	90	Fair	do	do	Poor	284
14017	131	64	57.4	2,200	499	83	92	Good	do	Light brown	Fair	288
13913	147	61	58.7	2,120	500	91	92	Fair	Light creamy	Brown	Poor	288
13729	139	64	59.5	1,950	510	87	92	do	do	Light brown	Fair	294
14033	131	61	59.5	1,900	512	83	82	Fair, crumbly	Creamy	do	Poor	295
14090	147	62	60.2	1,850	517	76	86	Fair	Very creamy	Brown	do	298
14091	139	62	58.0	1,880	508	81	85	do	Creamy	do	do	293

14255	132	70	60.1	1,980	511	86	90	Good	do	Light brown	do	235
13549	117	54	57.3	2,190	505	90	93	Excellent	Creamy, gray	Brown	Good	291
13550	151	57	58.3	2,350	500	90	93	do	Light creamy	Light brown	do	288
13551	154	61	57.9	2,180	507	89	92	Good, crumbly	Creamy	do	do	292
13737	142	61	59.7	2,050	514	90	93	Good	do	do	Fair	296
13738	149	61	59.7	2,160	505	91	94	Excellent	Light creamy	Brown	do	291
13742	147	63	58.6	2,140	502	89	92	do	do	do	do	289
Average	139	63	58.2	2,112	504	87	91	Good	Creamy	Light brown	do	290
13916	122	59	55.4	2,020	497	86	86	Fair, crumbly	do	do	Poor	267
13928	115	62	52.9	2,120	485	88	88	Poor, crumbly	Light creamy	do	do	280
14038	106	62	53.0	2,160	491	84	87	Fair, crumbly	Light creamy, gray	do	do	283
13917	117	62	53.6	2,020	487	89	90	Fair	Light creamy	Pale	do	291
14296	108	65	50.1	2,330	479	93	92	Good	do	Light brown	do	276
14297	106	63	51.2	2,200	485	91	90	do	Light creamy	do	do	280
14479	122	63	53.1	2,120	486	89	90	Fair, crumbly	Creamy	Pale	Fair	280
14480	119	63	51.8	2,070	488	88	88	do	Light creamy	do	Poor	277
13918	114	61	54.6	2,060	492	89	89	do	do	do	do	274
13929	112	64	52.5	2,100	484	90	86	Poor, crumbly	do	Light brown	Very poor	279
14005	97	62	52.4	2,120	487	87	91	Fair	do	do	Poor	281
14012	105	63	52.6	2,220	485	87	91	Good	Creamy	do	do	280
14013	103	62	51.2	2,180	485	88	89	Fair, crumbly	Light creamy	do	Fair	280
13907	117	65	54.3	2,200	492	90	92	do	do	do	do	284
13741	114	61	55.7	2,190	492	90	93	Excellent	do	Brown	do	284
13739	122	59	53.9	2,100	492	87	92	Good	Creamy	Light brown	Poor	284
13740	113	57	55.3	2,080	497	86	90	do	do	Brown	do	287
13930	117	63	51.9	1,990	483	89	88	Poor, crumbly	Light creamy	Light brown	do	278
14037	109	61	53.5	2,080	492	88	90	Fair, crumbly	Creamy	do	do	284
14095	105	61	51.3	2,050	492	88	79	do	Light creamy, gray	do	do	284
13908	120	64	53.5	2,050	490	90	92	do	Light creamy	do	do	282
14093	110	63	55.4	1,850	501	80	75	Fair	Very creamy	Light brown	do	289
14094	107	61	55.8	1,860	506	84	62	Poor, crumbly	Creamy, gray	do	do	291
Average	112	62	53.3	2,098	490	88	87	Fair	Light creamy	do	do	283
14302	108	52	51.5	2,150	486	90	90	Good	Creamy	Brown	do	280
14303	112	60	55.1	2,120	503	91	86	do	do	do	Fair	290
13733	121	60	60.7	1,980	509	91	90	Good, crumbly	Light creamy	do	Good	293
13932	116	62	58.3	1,960	502	86	82	Poor, crumbly	Creamy	do	Poor	289
14461	126	65	61.9	1,890	518	90	88	Fair, crumbly	Light creamy	do	Fair	299
13565	131	59	57.4	2,030	506	86	92	do	Creamy	do	do	291
13732	120	59	56.7	2,050	501	90	87	Poor	Creamy, gray	do	Good	289
13931	111	53	53.2	1,920	493	84	80	Poor, crumbly	Creamy	do	Poor	284
13933	105	58	53.9	1,960	494	86	84	do	do	Pale	do	285
14040	107	59	52.4	2,030	491	87	87	Fair, crumbly	do	do	do	283
14060	104	58	54.2	1,960	496	86	81	do	do	do	do	286
14041	105	58	52.5	1,890	491	87	86	do	do	do	do	283
14042	110	57	51.3	1,730	492	76	55	Poor, crumbly	Very creamy	do	do	284
14301	109	57	51.5	1,920	489	86	81	Fair	Creamy	Brown	do	282
13556	121	57	54.7	2,060	497	88	92	Good	do	do	Fair	287
13557	121	53	52.2	1,870	492	89	90	Fair	do	Light brown	Poor	284
Average	114	58	54.8	1,970	498	87	84	Poor	do	do	do	287

Because of the small quantity of spring wheat exported and the fact that the distribution is scattered widely throughout Europe, a sample from only one cargo of spring wheat was secured. From a milling standpoint and judging by the sample this wheat is somewhat below average, as it would take 280 pounds of this wheat to make a barrel of flour.

Eleven samples representing cargo shipments of durum wheat were received.[3] Wheat in these cargoes was of excellent milling quality, according to the sample, averaging over 61.1 pounds in test weight per bushel and yielding on the average 70.4 per cent of flour, dockage-free basis. For durum wheats the bread-making quality was good. The bread made from the durum flour was slightly creamy, but the loaves were very acceptable in volume and in texture.

Samples from 33 cargoes of hard red winter wheat were received from European ports. These cargoes averaged 60.2 pounds in test weight, contained 1 per cent of dockage, 1.2 per cent of inseparable foreign material other than dockage, and 0.9 per cent of damaged kernels. The average flour yield, dockage-free basis, was 70.2 per cent. In many instances the flour yield was much higher. An average for the 33 cargoes showed that 271 pounds of wheat would be required to manufacture a barrel of flour out of the hard red winter export wheat. The protein content of the wheat was 10.82 per cent, calculated on a 13.5 per cent moisture basis. The protein content of the resulting straight grade of flour was 10.04 per cent, on the same basis. Associated with this low protein content was a low average water absorption value for the flour. For the same reason the fermentation time of the dough was shorter than is usually true in the case of hard red winter wheat flour.

Although in 85 per cent of the instances the volume of the loaf of bread was satisfactory, an examination of the texture of the bread and of the break and shred of the loaf showed that approximately 40 per cent of the hard winter flours were slightly deficient in baking strength. On the other hand, there were some excellent wheats in the group.

All of the 23 samples of soft red winter wheat obtained overseas were clean. They contained, on an average, 0.4 per cent of dockage, 0.6 per cent foreign material other than dockage, and 2.6 per cent of damaged kernels.

From a milling standpoint the quality of the soft red winter export samples was not quite so good as that of the hard red winter exports, for it would be necessary to use 276 pounds of the soft red winter wheat to produce a barrel of flour as compared with 271 pounds of hard red winter wheat.

The quality of the bread made from the soft red winter wheat flours was not quite so good as that obtained from the baking of the hard red winter wheat flours, the most noticeable points of difference being in the grain and texture of the crumb of the loaf. Practically the same quantity of bread, however, resulted from a barrel of flour milled from either class of wheat, being 290 pounds in the instance of the hard red winter wheat flour and 291 pounds for the soft red winter wheat flour. The protein in the soft red winter wheat flour

[3] Since considerable quantities of durum wheat are shipped overseas by way of Montreal, Canada, where it is mixed with Canadian durum wheat, the identity of the cargoes moving out of Montreal will have to be assumed.

was apparently of better quality than that in the hard red winter wheat flour as a smaller quantity was present in the soft wheat flour and the average loaf volume was approximately the same.

Sixteen samples were obtained representing cargoes of white wheat. These cargoes contained a more variable type of wheat than has been heretofore mentioned. Samples of eight cargoes represented the subclass hard white, three the subclass soft white, and three the subclass western white. According to the United States standards, wheats of the white class become progressively less valuable from a baking standpoint as the subclass changes from hard white to western white.

Among the white wheats examined, but one cargo was of a grade below No. 2. There was slightly more dockage in the white wheats than in the hard red winter or soft red winter wheats. On the other hand, the percentage of inseparable foreign material and the percentage of damaged kernels were less. The weight per measured bushel averaged 59.5 pounds, varying between 58.3 pounds and 61.5 pounds.

From the standpoint of the average test weight per measured bushel and the standpoint of flour yield, the milling quality of the white class was somewhat low, as, on the average, it would be necessary to use 280 pounds of wheat to produce a barrel of flour.

From a baking standpoint, as compared with the four other classes of flour just discussed, the flour milled from these white wheats lacked baking strength. Volume of loaf, except for the wheats carrying the designation "hard white," was low, as were, in most instances, the grain and texture of the crumb and the break and shred of the crust. Water absorption of the flour was below the average for this class of wheat. In a general way the relationship between subclass and baking quality was apparent.

For additional information relative to the quality of the wheat exported from the United States, milling and baking tests were made every month during the crop year 1926–27 upon composite samples of the several classes of wheat exported from two interior markets and six seaboard markets.

The results of the milling and baking tests as well as other pertinent data from this study are given in Tables 22, 23, and 24, which cover 14 hard red spring wheats, 34 hard red winter wheats, 40 soft red winter wheats, and 30 white wheats.

Fortunately, with the supplementary study, it has been possible to secure more evidence regarding the quality of the spring wheat exported from the United States. These data will be found at the top of Tables 22, 23, and 24.

TABLE 22.—*United States export wheats: Ports and dates of loading, and description and characteristics of samples taken at port of loading*

Laboratory No.	Port of loading	Date of shipment	Trade designation	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
						Per cent	*Per cent*	*Pounds*	*Per cent*	*Per cent*
13327	Duluth	June, 1926	1 Dark Northern Spring.	Hard red spring	1 Dark Northern Spring	0.1	89.6	59.0	0.8	0.9
13427	do	July, 1926	do	do	do	.1	88.9	59.2	.3	.9
13528	do	August, 1926	do	do	do	.2	83.9	59.1	1.0	.7
13705	do	September, 1926	do	do	do	.1	80.2	60.3	1.1	1.0
13896	do	October, 1926	do	do	do	.1	79.9	59.5	.5	.8
13947	Duluth	November, 1926	do	do	do	.0	80.9	59.3	1.2	.3
14063	do	December, 1926	do	do	do	.0	86.8	59.2	.5	.7
14434	do	May, 1927	do	do	do	.0	81.1	59.6	.9	.7
14527	do	June, 1927	do	do	do	.1	82.4	59.4	.8	.8
13329	New York	June, 1926	do	do	do	.1	77.4	60.2	1.8	.5
14429	Seattle	April, 1927	do	do	do	1.4	90.3	58.6	1.0	.3
14430	do	do	2 Dark Northern Spring.	do	2 Dark Northern Spring	.7	90.6	58.3	2.1	.3
13897	Duluth	October, 1926	1 Northern Spring	do	1 Northern Spring	.1	61.8	59.8	.9	.0
14070	Seattle	December, 1926	2 Northern Spring	do	2 Northern Spring	1.0	55.6	60.7	2.6	.7
	Average					.3	80.7	59.4	1.1	.6
14608	Chicago	July, 1927	1 Hard Winter	Hard red winter	1 Hard Winter	.3	55.9	61.1	.5	.1
14609	do	do	do	do	do	.4	58.7	60.3	.6	1.0
13944	Seattle	November, 1926	do	do	1 Hard Winter (scoured)	1.2	64.8	60.9	.0	.5
13428	Chicago	July, 1926	2 Hard Winter	do	2 Hard Winter (scoured)	.3	54.3	59.8	1.2	.9
13520	do	August, 1926	do	do	do	.4	39.2	59.5	1.4	.8
13708	do	September, 1926	do	do	do	.4	31.2	58.9	2.6	1.7
13898	do	October, 1926	do	do	do	.2	38.6	59.4	3.3	1.1
14064	do	December, 1926	do	do	do	.1	46.0	60.1	2.4	.7
13432	Galveston	July, 1926	do	do	do	.1	66.2	60.2	.4	1.7
13530	do	August, 1926	do	do	do	.2	59.7	59.4	.6	1.3
13712	do	September, 1926	do	do	do	.1	57.8	59.6	.5	1.9
13905	do	October, 1926	do	do	do	.1	60.0	59.4	2.3	1.6
13949	do	November, 1926	do	do	do	.3	55.5	59.5	2.2	2.0
14067	do	December, 1926	do	do	do	.0	55.8	59.6	1.4	1.8
14111	do	January, 1927	do	do	do	.0	52.8	59.6	1.7	1.8
14139	do	February, 1927	do	do	3 Hard Winter	.0	55.2	59.7	1.2	2.6
14221	do	March, 1927	do	do	2 Hard Winter	.2	54.7	60.3	1.6	2.0
14428	do	April, 1927	do	do	do	.3	50.3	60.3	.4	1.8
14441	do	May, 1927	do	do	do	.0	57.1	60.2	.5	1.5
14528	do	June, 1927	do	do	do	.0	55.6	60.7	.4	1.6
13711	New Orleans	September, 1926	do	do	do	.4	43.9	59.3	2.1	1.2

13904	do	October, 1926	do	do	do	.1	44.2	58.8	2.0	1.6
13948	do	November, 1926	do	do	do	.4	47.2	59.4	3.0	1.2
14110	do	January, 1927	do	do	do	.4	49.5	59.9	2.9	1.8
14220	do	March, 1927	do	do	do	.5	51.6	60.0	2.2	1.8
14427	do	April, 1927	do	do	do	.3	47.8	60.2	1.6	1.5
14439	do	May, 1927	do	do	do	.0	49.6	60.3	1.6	1.6
13430	New York	July, 1926	do	do	1 Hard Winter	.1	68.8	61.2	.4	.5
13706	do	September, 1926	do	do	2 Hard Winter	.2	40.4	60.2	1.3	.4
13900	do	October, 1926	do	do	do	.2	38.4	59.9	1.5	1.3
14066	do	December, 1926	do	do	do	.2	40.6	59.3	1.9	1.0
14140	San Francisco	April, 1927	do	do	do	.2	29.6	60.1	.0	.0
13713	Seattle	September, 1926	do	do	1 Hard Winter (washed and scoured).	.9	68.4	61.6	.0	.4
13945	do	November, 1926	do	do	2 Hard Winter (scoured)	1.0	72.2	61.4	.0	1.3
	Average					.3	51.5	60.0	1.3	1.3
13532	Baltimore	August, 1926	2 Red Winter	Soft red winter	2 Red Winter	.0		59.9	1.3	.3
13710	do	September, 1926	do	do	do	.2		59.7	2.5	.5
13906	do	October, 1926	do	do	do	.2		59.5	4.0	.3
14069	do	December, 1926	do	do	do	.0		59.4	2.3	.3
14109	do	January, 1927	do	do	do	.2		59.9	2.4	.5
14137	do	Februry, 1927	do	do	do	.0		59.7	3.6	.6
14224	do	March, 1927	do	do	do	.2		59.8	2.5	.7
14424	do	April, 1927	do	do	do	.0		60.0	2.4	.3
14437	do	May, 1927	do	do	do	.0		60.3	2.1	.1
14532	do	June, 1927	do	do	1 Red Winter	.0		60.5	1.5	.5
13429	Chicago	July, 1926	do	do	2 Red Winter	.1		59.7	.6	.3
13899	do	October, 1926	do	do	do	.1		59.3	1.0	.6
13950	do	November, 1926	do	do	do	.4		59.6	1.7	.7
14065	do	December, 1926	do	do	do	.3		59.6	1.2	.9
14438	do	May, 1927	do	do	do	.0		60.2	.5	.5
14530	do	June, 1927	do	do	do	.0		60.2	2.3	.5
14138	New Orleans	February, 1927	do	do	do	.0		59.1	1.9	1.3
14440	do	May, 1927	do	do	do	.0		59.6	2.1	.9
13531	New York	August, 1926	do	do	do	.0		59.9	1.0	.7
13707	do	September, 1926	do	do	do	.1		59.7	2.8	.3
13951	do	November, 1926	do	do	do	.0		59.7	2.8	1.3
14107	do	January, 1927	do	do	do	.2		59.7	3.0	1.0
14223	do	March, 1927	do	do	do	.1		60.4	2.2	.2
14425	do	April, 1927	do	do	do	.0		60.1	3.5	.5
14435	do	May, 1927	do	do	1 Red Winter	.0		60.5	1.8	.4
14529	do	June, 1927	do	do	do	.0		60.4	1.7	.6
13328	Philadelphia	June, 1926	do	do	2 Red Winter	.1		60.4	2.8	.3
13431	do	July, 1926	do	do	do	.0		59.7	2.8	1.5
13709	do	September, 1926	do	do	do	.2		59.8	3.1	.5
13901	do	October, 1926	do	do	do	.1		60.0	3.0	1.4
13952	do	November, 1926	do	do	do	.2		59.9	4.0	.8
14108	do	January, 1927	do	do	do	.0		59.8	2.6	.9
14136	do	February, 1927	do	do	do	.0		59.6	3.1	1.2
14122	do	March, 1927	do	do	do	.1		60.2	2.0	1.5
14426	do	April, 1927	do	do	do	.0		60.2	2.2	1.0
14436	do	May, 1927	do	do	do	.0		60.7	1.8	1.5
14531	do	June, 1927	do	do	do	.0		60.3	2.3	1.3

TABLE 22.—*United States export wheats: Ports and dates of loading, and description and characteristics of samples taken at port of loading*—Continued

Laboratory No.	Port of loading	Date of shipment	Trade designation	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
						Per cent	*Per cent*	*Pounds*	*Per cent*	*Per cent*
13533	Seattle	August, 1926	2 Western Red	Soft red winter	2 Western Red (scoured)	0.6		59.8	0.0	0.6
13714	do	September, 1926	do	do	1 Western Red (washed and scoured).	.9		61.0	.0	.5
14144	do	February, 1927	do	do	2 Western Red (washed and scoured).	1.0		60.0	.2	.2
	Average					.1		60.0	2.1	.7
13332	San Francisco	June, 1926	1 Hard White	White	1 Hard White	.2	94.0	64.4	.1	.2
13536	do	August, 1926	do	do	do	.5	84.0	63.8	.0	.1
13718	do	October, 1926	do	do	do	.4	94.6	62.9	.1	.2
13055	do	November, 1926	do	do	do	.1	94.8	61.8	.0	.1
13956	do	do	do	do	do	.5	89.0	63.4	.0	.0
14141	do	February, 1927	do	do	do	1.0	80.1	63.8	.2	.2
14142	do	do	do	do	do	.7	88.4	61.6	.0	.4
14143	do	do	do	do	do	.7	83.0	62.1	.1	.2
14217	do	March, 1927	do	do	do	1.1	84.0	63.5	.2	.1
14218	do	do	do	do	do	.7	76.7	62.8	.0	.0
14219	do	do	do	do	do	.6	91.3	61.6	.1	.3
14432	do	June, 1927	do	do	do	.6	91.3	61.5	.0	.2
14433	do	do	do	do	do	.5	90.2	61.9	.2	.6
14533	do	do	do	do	do	.6	87.2	62.4	.2	.5
14073	Seattle	January, 1927	do	do	do	.3	90.6	62.0	.1	.0
13330	do	June, 1926	2 Hard White	do	2 Hard White	.5	90.9	59.0	.2	.2
13434	do	July, 1926	do	do	do	.6	80.6	58.6	.0	1.4
13719	San Francisco	October, 1926	1 Soft White	do	1 Soft White	.0	55.6	63.5	.0	.2
13534	Seattle	August, 1926	2 Soft White	do	2 Soft White (washed and scoured)	.6	62.1	59.4	.2	.4
13716	do	September, 1926	do	do	do	1.0	60.4	59.5	.2	.3
13942	do	October, 1926	do	do	2 Soft White	1.2	64.8	58.9	.6	.4
13331	do	June, 1926	2 Western White	do	2 Western White	.6		59.2	.1	1.3
13535	do	August, 1926	do	do	2 Western White (washed)	.7		59.6	.2	.6
13717	do	September, 1926	do	do	2 Western White (washed and scoured).	1.0		59.7	.0	.4
13943	do	October, 1926	do	do	2 Western White (scoured)	.9		59.3	.4	.5
13946	do	November, 1926	do	do	2 Western White (washed and scoured).	1.0		59.1	.8	.6
14112	do	January, 1927	do	do	2 Western White (scoured)	.8		59.1	.6	2.0
14145	do	February, 1927	do	do	2 Western White	1.0		58.9	.6	.4
14225	do	March, 1927	do	do	do	1.1		59.2	.1	.5
14431	do	April, 1927	do	do	do	.8		59.4	.1	.3
	Average					.7	83.0	61.1	.2	.4

TABLE 23.—*United States export wheats: Milling properties of the samples described in Table 22, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Foreign material in wheat as milled	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
					Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Pounds*					*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	
13327	59.0	2.4	0.2	10.7	69.5	68.5	277	Hard	Granular	Slightly creamy	1.32	0.54	6.36	0.376	12.90	11.87	2.42
13347	58.9	1.9	.5	10.7	70.5	69.0	275	do	do	Creamy	.95	.50	6.41	.386	12.97	12.02	2.29
13528	59.7	2.1	.3	11.9	70.3	69.0	279	do	do	White	1.59	.53	6.49	.335	12.53	11.51	1.96
13705	60.8	2.1	.4	11.0	69.5	68.0	280	do	do	Slightly creamy	1.60	.51	6.37	.306	12.17	12.20	1.71
13896	60.4	2.7	.3	10.1	71.4	69.5	274	do	do	White	1.26	.51	6.39	.308	12.86	10.70	1.85
13947	60.2	3.0	.2	9.4	70.0	67.9	276	do	do	Slightly creamy	1.61	.46	6.37	.330	12.99	12.40	1.83
14063	60.5	2.7	.2	8.6	70.3	68.4	271	do	Soft	White	1.31	.51	6.70	.293	13.56	12.86	1.99
14434	60.2	1.1	.3	11.2	70.4	69.6	274	do	Granular	do	1.13	.50	6.68	.256	13.16	12.41	1.99
14527	60.2	1.5	.3	11.0	69.7	68.7	277	do	do	do	.99	.49	6.67	.320	13.39	12.63	1.92
13329	59.6	1.9	.1	11.4	69.0	67.9	282	do	do	Slightly creamy	2.01	.44	6.39	.328	12.62	11.68	2.14
14429	58.6	2.8	.0	10.9	71.6	70.6	270	do	do	do	1.03	.50	6.64	.291	13.57	13.09	1.99
14430	58.5	2.4	.0	10.9	68.3	67.2	283	do	do	White	1.08	.46	6.63	.274	13.86	13.40	2.25
13897	60.9	2.6	.4	10.2	70.9	69.0	277	do	do	do	1.37	.49	6.32	.304	11.60	10.70	1.88
14070	61.6	3.5	.5	9.3	70.2	68.4	273	do	do	do	.84	.54	6.61	.362	10.73	10.00	2.06
Average	59.9	2.3	.3	10.5	70.1	68.7	276	do	do	Slightly creamy	1.29	.50	6.50	.319	12.78	11.96	2.02
14608	62.3	1.7	.1	11.5	73.6	72.5	264	do	do	White	1.17	.57	6.59	.277	10.35	9.13	2.21
14609	61.6	1.8	.5	11.8	72.1	71.1	270	do	do	do	1.20	.53	6.57	.295	10.64	9.58	2.10
13944	61.7	5.0	.2	9.7	74.0	71.1	264	do	do	Slightly creamy	1.38	.49	6.39	.345	9.50	8.81	2.02
13428	60.1	2.4	.7	11.0	67.0	65.6	290	do	do	do	1.14	.53	6.41	.402	12.04	10.47	2.04
13529	60.6	2.2	.2	12.7	72.1	70.8	274	do	do	White	1.40	.49	6.61	.352	10.63	9.56	2.21
13708	61.2	2.6	.4	10.8	70.6	69.2	275	do	do	Slightly creamy	1.79	.49	6.38	.310	10.46	9.13	2.06
13898	60.9	3.3	.7	10.3	71.3	69.1	274	do	do	White	1.67	.50	6.30	.289	10.56	9.53	2.14
14064	61.7	2.8	.4	8.3	71.9	70.0	264	do	do	do	1.94	.55	6.68	.283	10.60	9.57	1.96
13432	60.9	1.7	.9	10.6	69.0	67.9	279	do	do	Slightly creamy	1.26	.49	6.46	.351	12.03	10.73	2.35
13530	60.5	2.6	.9	12.1	73.7	71.9	268	do	do	White	1.43	.51	6.55	.277	11.47	10.41	2.02
13712	60.6	3.0	1.0	10.6	70.5	68.5	277	do	do	do	1.36	.47	6.44	.222	11.20	10.33	2.25
13905	60.3	4.1	1.0	9.9	70.0	67.2	280	do	do	Slightly creamy	1.53	.49	6.46	.269	11.26	10.69	2.28
13949	60.7	4.1	1.5	9.2	72.2	69.4	269	do	do	do	1.40	.49	6.41	.296	11.46	10.89	2.09
14067	61.1	3.5	1.4	8.4	71.6	69.1	268	do	do	White	1.40	.49	6.67	.283	11.52	10.53	2.24
14111	61.0	2.7	1.4	8.7	73.3	71.3	260	do	do	Slightly creamy	1.11	.51	6.56	.322	11.71	10.67	2.38
14139	61.1	2.3	2.2	9.7	72.7	71.0	264	do	do	do	1.52	.52	6.54	.294	11.60	10.21	2.21
14221	61.5	3.0	1.7	9.9	72.8	70.7	266	do	do	do	1.35	.50	6.45	.391	11.81	10.84	2.33
14428	60.9	1.8	1.3	11.1	73.7	72.6	263	do	do	White	1.11	.55	6.64	.256	11.32	10.64	2.44
14441	61.0	1.8	1.2	11.0	73.0	71.8	267	do	do	do	1.42	.53	6.60	.276	11.54	10.84	2.62
13528	61.6	2.1	1.3	11.3	72.9	71.4	268	do	do	do	1.25	.51	6.64	.331	10.09	8.88	2.53
13711	60.4	3.5	.6	10.9	70.7	68.5	278	do	do	do	1.56	.51	6.38	.277	11.24	9.95	2.02
13904	60.2	4.5	.2	9.9	70.4	67.3	280	do	do	do	1.78	.48	6.27	.332	10.81	9.75	2.08

TABLE 23.—*United States export wheats: Milling properties of the samples described in Table 22, and certain chemical constituents of the wheats and of the flour made from them*—Continued

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Foreign material in wheat as milled	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
					Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Pounds*					*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	
13948	60.4	4.7	.8	9.2	71.9	68.8	271	Hard	Granular	Slightly creamy	1.59	.52	6.34	0.286	10.86	10.18	2.08
14110	60.8	3.0	1.4	8.7	73.3	71.4	260	do	do	do	1.24	.57	6.53	.256	11.12	10.16	2.18
14220	60.7	3.5	1.4	9.5	70.8	68.7	272	do	do	White	1.60	.51	6.46	.420	11.31	10.31	2.65
14427	60.7	1.9	1.0	11.3	71.6	70.5	271	do	do	do	1.33	.53	6.69	.293	11.06	10.03	2.33
14439	60.9	2.1	1.2	11.3	71.8	70.3	272	do	do	do	1.30	.57	6.60	.292	11.05	10.03	2.37
13430	61.8	1.8	.3	10.9	68.9	67.3	283	do	do	Slightly creamy	2.16	.55	6.78	.381	11.40	10.11	2.16
13706	61.4	2.0	.1	10.7	71.5	70.2	270	do	do	White	1.87	.50	6.41	.252	10.63	9.09	2.08
13900	60.8	3.2	.8	9.8	71.8	69.6	270	do	do	Slightly creamy	1.68	.54	6.42	.307	10.31	9.64	2.11
14066	60.8	2.9	.4	8.4	71.0	69.1	268	do	do	White	1.71	.49	6.66	.255	10.47	9.40	2.13
14140	61.5	1.7	.0	9.7	71.0	70.0	265	do	do	do	1.82	.51	6.58	.266	9.08	7.77	2.35
13713	62.3	3.7	.1	10.4	70.8	68.8	275	do	do	do	1.24	.48	6.44	.367	9.65	9.00	2.21
13945	62.1	4.5	.8	10.0	71.8	69.3	272	do	do	do	1.59	.65	6.36	.303	10.22	9.33	2.08
Average	61.1	2.9	.8	10.3	71.6	69.8	271	do	do	do	1.48	.52	6.51	.306	10.91	9.89	2.22
13532	60.3	2.7	.2	12.3	71.7	69.8	277	Soft	Soft	do	1.07	.48	6.52	.316	10.79	9.57	2.04
13710	60.0	3.1	.2	11.2	70.2	68.1	280	do	do	do	1.42	.44	6.30	.277	10.20	9.05	2.24
13906	59.5	4.4	.2	9.9	68.9	66.0	285	do	do	do	1.47	.41	6.30	.355	9.97	8.92	1.89
14069	59.6	3.9	.1	8.7	71.3	68.5	271	do	do	do	1.02	.45	6.60	.289	10.29	8.92	2.10
14109	60.3	2.7	.1	8.8	72.2	70.4	264	Semihard	Granular	Creamy	1.32	.55	6.50	.337	10.36	8.99	2.73
14137	59.6	2.6	.0	9.7	72.5	70.6	266	Soft	Soft	White	1.32	.55	6.52	.271	9.95	8.66	2.14
14224	59.8	4.0	.2	9.8	71.0	68.3	275	do	do	do	1.40	.50	6.38	.381	10.19	8.88	2.03
14424	60.3	1.5	.1	11.1	73.4	72.2	264	do	do	do	.95	.50	5.90	.450	10.25	8.91	2.44
14437	60.6	1.3	.0	11.4	70.3	69.4	276	do	do	do	1.16	.51	6.54	.285	10.26	9.16	2.34
14532	61.0	1.8	.2	10.8	69.1	67.9	283	do	do	do	.94	.45	6.61	.345	10.12	8.84	2.39
13429	59.8	1.8	.0	10.9	68.0	66.8	285	do	do	do	.80	.46	6.50	.402	11.20	9.69	2.39
13899	60.2	3.7	.2	9.9	69.7	67.2	280	do	do	do	1.33	.42	6.35	.312	9.89	8.93	1.78
13950	60.1	4.0	.5	8.8	70.3	67.8	274	do	do	do	1.93	.43	6.41	.319	10.00	9.20	1.41
14065	60.5	3.4	.5	8.3	73.3	71.0	260	do	do	do	1.51	.56	6.65	.288	10.17	9.08	2.21
14438	60.4	1.4	.3	11.3	70.8	69.8	274	do	do	do	.99	.50	6.47	.275	10.04	9.00	2.25
14530	60.6	1.8	.3	10.7	68.0	66.8	285	do	do	do	.97	.51	6.59	.364	9.91	8.80	2.48
14138	59.7	2.6	1.1	9.5	71.8	69.9	268	do	do	do	1.43	.56	6.44	.328	10.15	8.76	2.52
14440	59.7	1.6	.5	11.4	69.9	68.3	280	do	do	do	.98	.57	6.52	.293	10.27	9.12	2.78
13531	60.3	2.2	.2	12.2	70.3	68.7	281	do	do	do	1.05	.42	6.51	.249	10.27	9.07	1.95
13707	60.2	2.7	.1	10.8	69.0	67.2	283	do	do	Slightly creamy	1.28	.43	6.32	.201	10.23	8.90	2.02
13951	59.9	4.3	.5	9.2	70.1	68.3	273	do	do	White	1.22	.42	6.29	.314	10.05	9.04	2.02

14107	60.7	2.9	.2	8.3	72.4	70.4	263	do	do	do	1.33	.63	6.48	.339	10.23	9.45	2.34
14223	60.8	3.4	.2	9.7	71.5	69.1	272	do	do	do	1.43	.52	6.40	.390	10.02	8.98	2.08
14425	60.5	1.4	.2	11.2	71.0	70.0	273	do	do	do	1.10	.46	6.15	.330	10.46	8.84	1.82
14435	60.7	1.3	.3	11.2	70.1	69.2	276	do	do	do	1.17	.55	6.58	.275	10.03	9.19	2.29
14529	60.7	1.9	.2	10.9	70.1	68.8	277	do	do	do	1.15	.48	6.61	.352	11.31	10.66	2.21
13328	60.1	1.2	.1	11.2	70.5	68.8	278	do	do	do	.86	.57	6.40	.424	11.30	9.57	2.41
13431	59.5	2.3	.5	10.3	70.3	68.1	278	do	do	do	.73	.49	6.41	.428	11.54	9.96	2.15
13709	60.2	3.2	.3	10.9	69.5	68.4	278	do	do	Slightly creamy	1.45	.48	6.31	.330	10.48	9.27	2.30
13901	60.0	5.1	1.0	9.7	69.9	67.4	279	do	do	White	1.33	.40	6.36	.326	10.19	8.87	1.75
13952	60.1	5.0	.3	9.2	70.2	68.7	272	do	do	do	1.17	.45	6.35	.329	10.35	9.56	2.34
14108	60.6	2.9	.4	8.5	73.4	71.3	260	do	do	do	1.20	.54	6.50	.316	10.41	9.43	2.22
14136	60.0	3.3	.1	9.7	69.8	67.5	278	do	do	do	1.37	.55	6.57	.290	10.18	8.96	2.29
14222	60.5	3.4	1.0	9.7	70.4	68.1	284	do	do	do	1.50	.55	6.37	.413	10.25	9.14	2.27
14426	60.7	1.2	.6	11.4	70.2	69.3	276	do	Very soft	do	1.05	.48	6.08	.425	10.36	9.19	2.38
14436	61.0	1.7	1.3	11.3	70.4	69.2	276	do	Soft	do	1.12	.49	6.57	.299	10.33	8.90	2.33
14531	61.0	2.1	1.1	10.9	68.9	67.5	282	do	do	do	1.04	.48	6.58	.347	10.72	8.86	2.68
13533	60.1	4.2	.0	11.3	70.9	68.4	279	do	do	do	1.30	.41	6.55	.325	9.37	8.21	2.12
13714	61.5	3.7	.4	10.1	69.7	67.7	279	do	do	do	1.39	.41	6.48	.293	9.01	8.24	1.97
14144	60.8	3.5	.2	9.3	71.3	69.5	269	do	do	do	1.53	.52	6.50	.314	9.32	8.59	2.33
Average	60.3	2.8	.3	10.3	70.6	68.8	275	do	do	do	1.22	.49	6.44	.332	10.26	9.08	2.21
13332	64.2	1.6	.0	11.3	72.5	70.9	270	do	do	do	.64	.46	6.50	.429	9.91	8.50	2.69
13336	64.0	2.5	.0	11.4	72.3	70.8	271	Semihard	Granular	do	1.19	.52	6.57	.313	9.75	8.37	2.33
13718	63.1	3.8	.1	10.4	69.7	67.3	281	Soft	Soft	do	1.20	.47	6.38	.353	11.33	10.09	1.99
13955	62.1	3.7	.0	9.1	71.0	68.4	273	do	do	do	1.01	.50	6.42	.399	10.56	9.93	2.33
13956	63.6	3.8	.0	9.2	72.4	70.0	267	do	do	do	1.09	.55	6.39	.362	10.28	9.69	2.23
14141	64.1	2.5	.1	9.7	75.0	73.9	254	do	do	do	1.19	.59	6.49	.285	9.59	8.65	2.66
14142	62.1	2.6	.1	9.5	70.2	68.0	274	do	do	do	1.07	.58	6.48	.399	11.09	9.71	2.33
14143	62.7	2.4	.1	9.9	74.0	72.8	259	do	do	do	1.26	.59	6.58	.290	10.94	9.60	2.41
14217	63.4	3.7	.1	9.4	73.1	71.2	263	do	do	do	1.20	.55	6.51	.384	10.14	9.11	2.36
14218	63.3	2.7	.0	9.6	72.4	70.9	265	do	do	do	1.19	.55	6.45	.395	10.45	9.16	2.41
14219	62.1	3.3	.0	9.5	69.9	68.1	275	do	do	do	1.09	.54	6.40	.494	12.41	11.43	2.36
14432	61.6	2.3	.1	10.5	69.8	68.6	276	do	do	do	.91	.57	6.52	.345	12.36	10.95	2.74
14433	62.2	2.2	.0	10.6	68.3	66.1	287	do	do	do	.81	.53	6.50	.345	11.98	10.90	2.38
14533	62.9	2.3	.0	10.5	69.5	68.3	277	Semihard	do	do	.72	.46	6.58	.299	10.37	9.14	2.14
14073	62.6	3.3	.0	7.6	68.7	66.6	276	do	do	do	.83	.49	6.65	.301	11.56	9.05	2.46
13330	58.3	2.3	.0	10.7	70.5	68.7	276	do	do	do	.75	.52	6.38	.396	13.44	11.69	2.49
13434	58.4	3.2	.8	10.2	70.2	68.0	277	do	do	do	.75	.46	6.49	.384	12.01	10.50	2.20
13719	63.9	3.0	.1	10.2	70.9	68.7	275	do	do	do	1.18	.52	6.48	.308	9.17	8.06	2.13
13534	59.8	4.4	.1	11.5	70.5	67.8	283	do	do	do	1.16	.44	6.55	.339	10.92	9.35	2.54
13716	59.8	4.9	.1	10.6	70.7	68.9	275	do	do	do	1.26	.45	6.46	.348	10.74	9.55	2.04
13942	59.2	6.3	.0	10.9	71.7	68.0	280	do	do	do	.77	.47	6.41	.291	11.09	10.00	2.03
13331	58.4	2.4	.5	10.9	70.5	68.5	278	do	do	do	1.01	.58	6.34	.367	12.83	11.60	2.18
13535	59.8	4.3	.0	11.2	73.4	70.7	270	do	do	do	1.37	.50	6.50	.317	10.06	8.76	2.18
13717	60.0	4.7	.1	10.4	70.7	68.3	277	do	do	do	1.40	.48	6.35	.328	11.09	10.06	2.19
13943	59.5	7.4	.0	9.8	69.9	68.3	288	do	do	do	.81	.44	6.38	.312	10.80	9.68	2.24
13946	59.4	6.0	.4	9.9	71.4	67.8	277	do	do	do	1.59	.45	6.41	.284	10.22	9.33	2.19
14112	60.0	4.0	1.1	9.9	73.6	71.2	264	do	do	Slightly creamy	.95	.55	6.55	.319	11.88	11.01	2.06
14145	59.5	3.3	.0	9.8	72.2	70.5	267	do	do	White	1.37	.61	6.37	.299	9.32	8.59	2.36
14225	59.5	4.5	.3	10.5	69.5	67.1	282	do	do	do	1.20	.48	6.51	.417	10.92	9.68	2.00
14431	60.0	2.8	.2	10.7	69.1	67.7	280	do	do	do	1.16	.53	6.58	.263	10.77	10.19	2.00
Average	61.3	3.5	.1	10.2	71.1	69.1	274	Soft	do	do	1.07	.51	6.47	.348	10.94	9.77	2.29

TABLE 24.—*United States export wheats: Baking properties of the samples described in Tables 22 and 23*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*P. ct.*	*C. c.*	*Gm.*	*Score*	*Score*					*Pounds*
13327	141	70	57.3	2,140	500	80	91	Good	Creamy			288
13427	116	63	57.2	2,240	501	88	92	do	do			289
13528	168	67	57.4	2,080	501	88	91	Excellent	Creamy, gray	Brown	Poor	289
13705	150	65	57.9	2,250	496	90	91	Good	Light creamy	do	Excellent	286
13896	146	63	59.1	2,200	498	88	91	Fair, crumbly	Creamy	do	Good	287
13947	133	67	57.5	2,230	500	91	92	Good	Light creamy	do	do	288
14063	129	58	58.5	2,220	504	85	90	do	Creamy	do	Fair	291
14434	153	69	56.8	2,200	492	89	90	do	Light creamy, gray	do	do	284
14527	151	63	59.2	2,060	499	89	92	Fair	Light creamy	do	Good	288
13329	202	67	60.0	2,180	504	80	90	Good	Creamy			291
14429	149	64	58.2	2,170	502	88	90	do	Light creamy	Brown	Good	289
14430	147	64	58.8	2,110	504	88	90	do	do	do	do	291
13897	151	64	59.0	2,140	504	88	91	do	Creamy	do	Excellent	291
14070	135	61	58.6	1,970	506	86	90	Fair	do	Light brown	Fair	291
Average	148	65	58.2	2,156	501	87	91	Good	Light creamy	Brown	Good	289
14608	176	68	56.0	2,010	490	88	90	do	Creamy	Light brown	Poor	282
14609	163	66	55.7	2,000	491	88	90	do	do	do	do	283
13944	142	70	59.6	1,950	511	90	90	Fair, crumbly	Light creamy	do	do	295
13428	110	63	58.1	2,240	504	88	92	Good	Creamy			291
13529	156	69	57.7	2,180	505	86	91	Excellent	do	Brown	Good	291
13708	154	67	57.0	2,150	496	88	90	Good, crumbly	do	Light brown	Fair	286
13898	143	65	56.3	2,170	497	88	93	Good	do	do	do	287
14064	125	62	56.9	2,260	499	83	92	do	Very creamy	Brown	Poor	288
13432	105	59	59.6	2,200	508	88	91	do	Creamy			293
13530	158	66	58.6	2,130	506	89	92	do	Light creamy, gray	Brown	Fair	291
13712	145	65	58.3	2,190	501	89	93	do	Light creamy	do	Good	289
13905	142	64	58.5	2,180	502	88	91	Good, crumbly	Creamy	do	Fair	289
13949	132	62	55.1	2,200	493	92	92	Good	Light creamy	do	do	284
14067	120	61	58.3	2,210	507	87	92	Fair	do	Light brown	do	292
14111	120	61	56.5	2,240	500	88	86	do	Creamy	Brown	Good	288
14139	127	61	57.7	2,260	502	87	91	Fair, crumbly	do	Light brown	Poor	289
14221	138	70	56.9	2,300	500	87	92	Good	do	do	Good	288
14428	143	67	57.9	2,140	500	85	89	Fair, crumbly	do	Pale	Fair	288
14441	153	62	57.8	2,190	498	89	88	do	Light creamy	Brown	do	287
14528	140	61	58.1	2,150	495	89	89	Good	do	Light brown	Poor	285
13711	146	66	58.4	2,210	498	88	92	Excellent	do	Brown	Good	287
13904	145	65	59.1	2,180	500	89	92	Good, crumbly	Creamy	Light brown	Fair	288
13948	139	70	58.1	2,300	500	88	91	Good	Light creamy	do	Poor	288
14110	129	60	57.0	2,190	502	86	80	Fair	Creamy	Brown	Good	289
14220	140	66	57.1	2,280	494	86	90	Good	do	do	Fair	285
14427	130	70	55.7	2,470	489	88	92	do	do	Light brown	do	282
14439	121	70	58.3	2,200	499	88	90	Fair	Light creamy	Pale	Poor	288

13430	105	60	56.8	2,090	504	88	92	Good	Creamy			291
13706	144	67	58.1	2,200	499	88	91	do	do	Brown	Good	288
13900	144	64	56.4	2,170	497	87	92	Good, crumbly	do	Light brown	Fair	287
14066	121	[illegible]	57.1	2,210	503	82	91	Good	Very creamy	do	Poor	290
14140	134	61	56.7	2,090	504	88	90	Fair	Creamy	do	do	291
13713	140	62	62.6	1,960	515	87	92	Good, crumbly	do	do	Fair	297
13945	137	71	60.9	2,100	511	90	91	Good	Light creamy	do	Poor	295
Average	137	65	57.7	2,176	501	88	91	do	do	do	Fair	289
13532	133	69	52.9	2,190	490	91	92	do	Light creamy, gray	Brown	Poor	282
13710	120	62	55.2	2,260	485	91	92	Good, crumbly	Light creamy	Light brown	do	280
13906	120	65	54.7	2,220	492	90	93	Fair, crumbly	do	do	do	284
14069	106	61	53.9	2,190	491	88	90	Fair	do	do	do	283
14109	108	62	54.1	2,110	494	86	80	Fair, crumbly	Creamy	do	Fair	285
14137	109	60	52.5	2,150	492	88	88	Fair	do	do	Poor	284
14224	119	65	54.1	2,320	486	88	90	Good	do	do	Fair	280
14424	117	67	53.2	2,270	480	91	90	Fair, crumbly	Light creamy	Pale	Poor	277
14437	122	74	52.2	2,220	485	89	90	do	do	Light brown	do	280
14532	126	70	52.7	2,080	484	89	90	do	do	Pale	Fair	279
13429	90	62	54.1	2,280	492	90	92	Good	do			284
13899	112	69	54.9	2,260	491	90	89	Good, crumbly	Creamy, gray	Brown	Fair	283
13950	116	63	53.2	2,140	477	92	91	Good	Light creamy	Light Brown	Poor	275
14065	111	61	53.8	2,020	492	84	86	Fair	Creamy, gray	Brown	Fair	284
14438	128	75	53.5	2,220	478	91	90	do	Light creamy	Pale	Poor	276
14530	104	68	52.5	2,030	482	88	88	Poor, crumbly	Creamy, gray	do	Fair	278
14138	110	62	52.4	2,040	492	86	90	Fair, crumbly	do	Light brown	Poor	284
14440	133	75	52.5	2,070	486	90	89	Fair	Light creamy	Pale	do	280
13531	136	69	53.4	2,140	493	89	92	Good	Light creamy, gray	Brown	do	284
13707	128	65	55.9	2,110	493	89	91	Fair, crumbly	Light creamy	Pale	Fair	284
13951	112	66	52.6	2,160	481	92	90	do	do	Light brown	Poor	277
14107	105	58	53.1	1,990	497	82	[1] 51	Poor, crumbly	Creamy, gray	do	do	287
14223	115	60	52.9	2,150	488	87	90	Fair	Creamy	do	Fair	281
14425	122	68	51.9	2,250	477	91	91	do	Light creamy	Pale	Poor	275
14435	120	69	54.0	2,190	487	89	90	Fair, crumbly	do	do	do	281
14529	115	68	53.8	2,170	484	90	90	Good	Light creamy, gray	do	Fair	279
13328	101	66	54.6	2,210	482	84	89	Good, crumbly	Creamy, gray			278
13431	85	61	56.6	2,240	499	87	93	Good	do			288
13709	121	65	55.5	2,220	501	90	90	Good, crumbly	Light creamy	Light brown	Fair	289
13901	116	64	54.5	2,270	492	90	90	do	do	do	do	284
13952	110	65	53.6	2,290	489	88	91	Fair	do	do	Poor	282
14108	112	61	52.4	2,100	490	87	79	Fair, crumbly	Creamy	do	Fair	282
14136	112	58	53.0	2,110	493	88	89	Fair	do	Pale	Poor	284
14222	116	61	52.7	2,260	483	88	91	do	do	Light brown	Fair	278
14426	118	65	51.4	2,150	480	90	92	do	Light creamy	Pale	Poor	277
14436	119	70	53.3	2,220	485	90	90	Fair, crumbly	do	do	do	280
14531	122	67	53.8	2,040	486	89	89	do	do	do	Fair	280
13533	125	71	55.7	1,950	498	87	90	do	Creamy	Brown	Poor	287
13714	125	64	55.5	2,000	497	89	89	do	do	Pale	do	287
14144	108	57	52.8	1,810	495	86	77	Poor, crumbly	do	Light brown	do	285
Average	116	65	53.6	2,152	488	89	89	Fair	Slightly creamy	do	do	282

[1] Omitted from average.

TABLE 24.—*United States export wheats: Baking properties of the samples described in Tables 22 and 23*—Continued

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*P. ct.*	*C. c.*	*Gm.*	*Score*	*Score*					*Pounds*
13332	120	71	57.7	2,000	491	90	92	Good	Creamy, gray			285
13536	119	55	54.3	2,110	497	92	93	Excellent	Light creamy	Light brown	Good	287
13718	113	62	55.3	2,190	495	90	92	Good	do	Brown	do	285
13955	136	64	54.4	2,160	491	90	92	do	do	do	Poor	283
13956	131	62	54.6	2,140	498	90	92	Fair	do	Light brown	do	287
14141	109	62	54.7	1,900	498	88	88	do	Creamy	Brown	do	287
14142	110	58	55.7	2,000	505	86	86	Fair, crumbly	do	do	do	291
14143	107	59	54.4	1,980	496	87	85	Fair	Creamy, gray	do	do	286
14217	121	64	54.5	2,050	495	88	91	Good	Creamy	do	do	285
14218	120	67	55.5	2,090	495	88	91	do	do	do	Fair	285
14219	112	58	57.6	2,240	496	88	92	do	do	do	Good	286
14432	119	57	53.5	2,000	490	88	88	Poor, crumbly	do	Foxy brown	Poor	282
14433	114	62	53.9	2,270	487	93	90	Good, crumbly	Light creamy	do	Fair	281
14533	124	68	53.8	2,120	489	90	88	do	do	Pale	do	282
14073	107	51	56.6	2,180	503	89	91	Good	do	Brown	do	290
13330	127	71	52.9	2,200	485	88	91	Good, crumbly	Creamy gray			280
13434	105	64	56.4	2,210	499	90	92	Excellent	Creamy			288
13719	114	61	54.2	2,010	495	90	91	Good	Light creamy	Brown	Fair	285
13534	121	58	55.4	1,960	495	89	89	Fair, crumbly	do	Light brown	do	286
13716	125	64	54.7	2,130	490	89	89	do	Creamy	Pale	do	282
13942	106	58	54.1	1,990	488	86	87	do	Light creamy	do	Poor	281
13331	122	65	55.7	2,190	486	82	92	Good, crumbly	Creamy			280
13535	117	56	52.1	1,730	490	82	78	Fair, crumbly	Very creamy	Light brown	Poor	282
13717	113	61	53.8	2,140	488	88	92	Good	Light creamy	do	Fair	281
13943	111	62	52.1	2,060	485	84	86	Poor, crumbly	Creamy	Pale	Poor	280
13946	110	60	55.6	2,050	500	90	86	Fair, crumbly	Light creamy	Light brown	do	288
14112	100	57	54.4	1,950	501	84	68	Poor, crumbly	Creamy, gray	Brown	do	289
14145	105	56	53.1	1,900	500	85	70	do	Very creamy	Light brown	do	288
14225	110	60	53.9	2,170	490	88	88	Good	Creamy	do	Fair	282
14431	122	65	53.5	2,110	495	88	88	Good, crumbly	Light creamy, gray	do	do	285
Average	116	62	54.6	2,074	494	88	87.9	Good	Creamy yellow	do	do	285

It is apparent from the data supplied from the milling of the hard red spring wheat samples that they were of fair average quality. The average test weight, dockage-free basis, was 59.4 pounds. The yield of flour on the same basis averaged 68.7 per cent. With such figures it is readily computed that the quantity of wheat necessary to manufacture a barrel of flour will be, in round numbers, 276 pounds. Such figures compare closely with those obtained from the milling of No. 3 Manitoba Northern wheat.

On the other hand, with the exception of the fact that it was possible to make only an average number of loaves of bread from the flour milled from the hard red spring wheats, the baking quality of the flour was fairly good. Size of loaf, color of crumb, grain and texture of the crumb, as well as crust color, and break and shred, were normal for this class of wheat.

The grading data on the monthly composite samples of hard red winter wheat compare closely with the average data obtained from the Superintendence Co.'s samples of the same class. On an average basis, the quantity of dockage in the monthly composite samples was 0.3 per cent, as compared with 1 per cent; kernel texture was 51.5 per cent, as compared with 58.5 per cent; test weight per bushel was 60 pounds, as compared with 60.2 pounds; damaged kernels were 1.3 per cent, as compared with 0.9 per cent; foreign material other than dockage was 1.3 per cent, as compared with 1.2 per cent.

Similarly with the soft red winter wheat samples, on an average basis, the dockage of the monthly composites was 0.1 per cent as compared with 0.4 per cent; the test weight per bushel was 60 pounds, as compared with 59.7 pounds; damaged kernels were 2.1 per cent, as compared with 2.6 per cent; the average quantity of foreign material other than dockage was 0.6 per cent in both instances.

From a milling standpoint the hard red winter wheat monthly composites were of the same quality as the average of the company's samples for this same class of wheat. The average weight of wheat necessary to make a barrel of flour from both series of samples was the same, namely, 271 pounds.

The milling quality of the monthly composite soft red winter wheats was practically the same as the company's samples of the same class, as the quantity of wheat necessary to make a barrel of flour averaged 275 pounds as against 276 pounds for the company's samples.

From a baking standpoint no large differences in quality were apparent in the flour milled from the hard red winter wheat obtained from either source. On the basis of average figures, the comparative data are as follows, the figures for the monthly composite samples being stated first in each instance: Fermentation time, 137 minutes, as compared with 139 minutes; proofing time, 65 minutes, as compared with 63 minutes; water absorption of flour, 57.7 per cent, as compared with 58.2 per cent; loaf volume, 2,176 cubic centimeters, as compared with 2,112 cubic centimeters; weight of loaf, 501 grams, as compared with 504 grams; color score of crumb, 88, as compared with 87; score of grain of crumb, 91 in both instances; shade of color of crumb, light creamy as compared with creamy; color of crust, light brown in each instance; pounds of bread per barrel of flour, 289, as compared with 290. As was the case with the Superintendence Co.'s hard red winter wheat samples, approximately 40 per cent

of the monthly composite sample flours exhibited some deficiency in baking strength.

For the soft red winter wheat flours the average comparative figures are as follows: Fermentation time, 116 minutes as compared with 112 minutes; proofing time, 65 minutes as compared with 62 minutes; water absorption of flour, 53.6 per cent as compared with 53.3 per cent; volume of loaf, 2,152 cubic centimeters as compared with 2,098 cubic centimeters; weight of loaf, 488 grams, as compared with 490 grams; color score of crumb, 89, as compared with 88; score of grain of crumb, 89, as compared with 87; texture of crumb, fair in each instance; color of crust, light brown in each instance; break and shred, poor in each instance; pounds of bread per barrel of flour, 282, as compared with 291. The baking quality of the company's samples was, therefore, the better.

The monthly composite white wheats were of somewhat better quality than those supplied for similar tests by the company. Higher bushel weights prevailed, as did higher flour yields, with the result that it took 6 pounds less of the wheat to make a barrel of flour than was necessary to use with the wheats supplied by the company. The ratio was 274 to 280 pounds.

There was also some superiority in the baking quality of the flours milled from the monthly composite wheats. This was largely a matter of loaf volume, and of interior characteristics of the loaf. On an average basis the comparative figures are as follows: Fermentation time, 116 minutes, as compared with 114 minutes; proofing time, 62 minutes, as compared with 58 minutes; water absorption of flour, 54.6 per cent, as compared with 54.8 per cent; volume of loaf, 2,074 cubic centimeters, as compared with 1,970 cubic centimeters; weight of loaf, 494 grams, as compared with 498 grams; color score of crumb, 88, as compared with 87; score of grain of crumb, 87.9, as compared with 84; texture of crumb, good as compared with poor; shade of color of crumb, creamy yellow, as compared with creamy; color of crust, light brown in both instances; break and shred, fair as compared with poor; pounds of bread per barrel of flour, 285, as compared with 287.

MILLING AND BAKING QUALITIES OF SOUTH AMERICAN WHEATS

Argentina, Chile, and Uruguay, are the important wheat producing countries in South America, Argentina outranking the other countries by far. The relative milling and baking quality of South American wheats will be found below.

ARGENTINA

Argentina ranks sixth among wheat-producing countries of the world, but when exports are considered it is exceeded only by the United States and Canada. Wheat is grown mostly in the Provinces of Buenos Aires and Cordoba, and to some extent in the Provinces of Santa Fe and Entre Rios, and the Territory of La Pampa. The first two Provinces produce about 70 per cent of the wheat of the country and the five areas together about 95 per cent of the crop. The trend of wheat acreage from 1890 to about 1912 was sharply upward; from that time until the drop in acreage following the World War, the increase in acreage was less rapid. After the postwar decrease, the trend in acreage has again been strongly upward.

Until 1900 most of the increase in wheat was to the north. In recent years this increase has been more rapid to the south and west, and particularly in La Pampa. The average production of wheat for the crop years 1924–25 to 1928–29 amounted to 237,000,000 bushels; the preliminary estimate for the crop year 1928–29 was 307,000,000 bushels. Further increase in production is strongly limited by high temperatures in the north and low temperatures and lack of rainfall to the south, and by uncertain rainfall to the west. Flax and corn likewise have competed successfully with wheat in the Province of Santa Fe, where the acreage of wheat has actually decreased during recent years.

The bulk of the Argentine wheat crop is usually seeded in June and July and harvested in December. It is possible to sow wheat over a long period. If the weather is dry during May and June, much more is seeded in the latter part of June and in July. Dry weather in May and June is not especially to be feared unless it continues well into June. In Buenos Aires, the most important wheat-producing Province, the bulk of the wheat is sown in July. Exports are made from the new crop in January and occasionally, to a slight extent, in December, but the heaviest movement usually comes in February or later. By the end of June over 70 per cent of the year's exports, on an average, has left the country, and by the end of May, 60 per cent has usually been exported. The Argentine exports thus move during the season when shipments from the Northern Hemisphere are normally lightest.

ARGENTINE VARIETIES

Among the varieties of wheat grown in Argentina, Barleta is probably the oldest and most widely sown. Barleta resembles the Turkey Red wheat of Kansas, but is somewhat softer. It was originally imported into Argentina by immigrating Italians and proved suitable for cultivation under the conditions of Argentine soil and climate. It is said to furnish an abundant product of good quality and to possess a high degree of resistance to drought, rust, hail, and excess heat. It is also less likely to be damaged by cold, damp fog, and late frost than are other varieties. It develops early and is hardy, qualities which explain the extent of its cultivation. As it does not shatter easily, it is able to withstand the violent winds during the ripening period, which reduces harvesting losses to a minimum. It also has good milling and baking quality.

Ruso is a commercial variety cultivated extensively in the western part of the Province of Buenos Aires and in the Territory of La Pampa. It was one of the chief wheats in this zone until recently; it is now being replaced by Kanred and other new pure varieties.

Favorito is a commercial variety, grown generally over the entire cereal zone of the country. It is a high-yielding variety but is being sown on decreasing acreages because of its inferior baking characteristics.

In the far north, that is, in northern Santa Fe and northern Entre Rios, where the soil and climate are not well suited to bread wheats, practically the only class of wheat grown is durum. The principal varieties of durum wheat sown are Candeal, Anchuel, and Tongarro.

Calchaqui and Peruano are the more important commercial varieties of winter wheat grown in the northern wheat country.

The Argentine Department of Agriculture is reported as giving much attention to developing new varieties adapted to Argentine conditions. As a result of this work the varieties known as Record, Universal, and San Martin are giving excellent results as regards yield, quality, and milling and baking properties.

The United States variety Kanred, a hard red winter wheat, is coming into favor on account of its ability to grow under southern Argentine conditions, and on account of the quality of the flour produced from it. Kanred is said to be especially adapted to the cold and drought experienced in southern Argentina, and likewise does well on sandy and poor lands. It has been found to produce wheat that is richer in protein and gluten than are some of the other varieties that can prosper on such lands.

A study of the milling and baking properties of certain Argentine wheat varieties was made possible through the courtesy of Ingeniero Carlos D. Girola, honorary director of the agricultural museum of the Argentine Rural Society of Buenos Aires, and Ingeniero Agr. Alejandro Botto, director general, Eusenanza Agricola, Buenos Aires, who sent samples of the following varieties: Barleta, Calchaqui, Candeal, Favorito, Peruano, Record, Ruso, San Martin, Sin Rival, and Universal II.

Under the grain standards of the United States, the varieties Barleta, Record, Ruso, and Universal II, would be classified as hard red winter wheats; the varieties Calchaqui, Favorito, San Martin, and Sin Rival, as soft red winter wheats; the variety Candeal, as a durum wheat; and the variety Peruano, as a white wheat. The grading characteristics of these samples are described in Table 25.

The data relative to the milling and baking qualities of the varieties tested are given in Tables 26 and 27.

TABLE 25.—*Wheats grown in Argentina: Description and characteristics of the variety samples*

Laboratory No.	Province where grown	Variety	Predominating class	Grade	Kernel texture	Test weight per bushel	Damaged kernels
					Per cent	*Pounds*	*Per cent*
13357	Buenos Aires	Universal II	Hard red winter	3 Dark Hard Winter	99.7	57.7	0.0
13655	do	do	do	1 Dark Hard Winter	99.2	60.2	.2
13358	do	Barleta	do	1 Hard Winter	79.4	62.1	.0
13650	do	do	do	do	76.3	62.5	.1
13359	do	*Record*	do	1 Dark Hard Winter	97.4	63.7	.0
13657	do	do	do	do	98.1	61.3	.0
13653	do	Ruso	do	3 Dark Hard Winter	85.1	57.5	.1
Average					90.8	60.7	.2
13640	Buenos Aires	San Martin	Soft red winter	2 Red Winter		62.3	4.0
13651	Salta	Calchaqui	do	2 Mixed (soft red winter, 62.2 per cent; white, 37.8 per cent).		58.5	1.2
13654	La Pampa	Favorito	do	1 Red Winter		60.3	.0
13658	Buenos Aires	Sin Rival	do	do		61.2	.6
Average						60.4	1.4
13656	La Pampa	Candeal	Durum	2 Mixed (durum, 88.1 per cent; soft red winter, 11.9 per cent).	54.4	58.9	.4
13652	Salta	Peruano	White	2 Mixed (white, 67.1 per cent; soft red winter, 32.9 per cent).		59.2	.0

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TABLE 26.—*Wheats grown in Argentina: Milling properties of the variety samples described in Table 25, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield: Basis cleaned and scoured wheat	Flour yield: Basis dockage-free wheat	Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour: Visual	Color of flour: Gasoline value	Ash in flour	Ash in wheat	Acidity of wheat as—: pH	Acidity of wheat as—: Lactic acid	Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Topfer angle θ)
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13357	58.1	1.3	11.7	67.2	66.3	289	Soft	Soft	White	0.77	0.45	1.47	6.15	0.284	16.01	15.08	5.81	8.19	14.00	41.50	2.38
13355	61.3	1.3	12.2	68.9	68.0	284	Hard	Granular	...do	1.18	.38	1.49	6.56	.169	12.74	11.71	4.20	6.23	10.43	40.27	2.16
13358	63.3	.8	11.1	73.0	72.4	263	Soft	Soft	...do	1.25	.50	1.57	6.36	.202	11.97	11.42	4.24	5.52	9.76	43.44	2.07
13650	63.9	.6	12.7	73.3	72.8	267	...do	...do	...do	1.57	.46	1.43	6.52	.170	12.06	11.10	4.07	5.23	9.30	43.76	2.14
13359	63.8	.9	12.6	70.4	69.4	280	...do	...do	...do	.86	.50	1.74	6.43	.297	10.84	9.69	3.72	4.71	8.43	44.13	2.58
13657	61.7	.8	12.7	68.9	67.5	287	Semihard	Granular	Slightly creamy.	1.24	.45	1.75	6.48	.272	11.82	10.69	3.79	5.63	9.42	40.23	2.02
13653	59.4	1.0	12.3	71.4	69.8	277	Soft	...do	White	1.51	.44	1.54	6.44	.275	12.95	12.28	4.52	6.35	10.87	41.58	1.99
Average	61.6	1.0	12.2	70.4	69.5	278	...do	Soft	...do	1.20	.45	1.57	6.42	.238	12.63	11.71	4.34	5.98	10.32	42.13	2.19
13649	62.6	.9	12.9	71.7	71.5	273	...do	...do	...do	.96	.39	1.60	6.46	.323	10.36	9.47	3.41	4.75	8.16	41.79	2.16
13651	60.3	2.2	12.1	72.9	71.3	270	Hard	Granular	...do	1.52	.61	1.73	6.59	.207	10.59	10.03	3.65	4.95	8.60	42.44	2.47
13654	60.0	1.5	12.3	71.4	70.3	275	Soft	Soft	...do	1.51	.43	1.46	6.56	.236	9.70	8.70	3.14	4.65	7.79	40.31	2.76
13658	62.2	1.1	12.4	68.4	67.7	286	...do	...do	...do	1.25	.38	1.57	6.36	.202	12.63	11.89	4.25	6.43	10.78	39.42	1.99
Average	61.3	1.4	12.4	71.1	70.2	276	...do	...do	...do	1.31	.45	1.59	6.49	.242	10.82	10.02	3.61	5.20	8.83	40.99	2.33
13656	58.7	2.1	11.9	68.3	66.9	288	Hard	Granular	Very creamy	2.13	.64	1.50	6.44	.295	10.65	9.63	3.75	4.61	8.36	44.86	2.13
13652	60.8	1.0	12.7	73.2	71.8	269	Soft	Soft	Creamy	1.64	.55	1.60	6.56	.228	8.30	7.59	2.77	3.43	6.20	44.68	2.70

TABLE 27.—*Wheats grown in Argentina: Baking properties of the variety samples described in Tables 25 and 26*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13357	115	49	60.1	2,010	498	87	90	Good	Creamy, gray			287
13355	151	61	59.9	2,060	504	94	92	Excellent	Light creamy	Brown	Excellent	291
13358	112	56	58.1	2,480	510	92	94	do	Light creamy, gray.			294
13650	134	49	56.0	1,920	504	88	86	Fair	Creamy, gray	Brown	Good	291
13359	114	65	60.9	1,850	520	90	92	Good	do			300
13657	146	61	61.0	1,870	517	92	92	do	Light creamy	Light brown	Fair	298
13653	136	55	59.4	1,920	515	88	92	Fair	Light creamy, gray.	Brown	Good	297
Average	130	57	59.3	2,016	510	90	91	Good	Creamy, gray	do	do	294
13649	113	56	58.3	1,830	508	91	92	do	Light creamy	do	Fair	293
13651	146	56	59.6	1,780	516	88	90	Fair	Light creamy, gray.	Light brown	do	297
13654	110	55	55.6	1,770	502	89	85	do	Creamy	Pale	do	289
13658	143	60	60.6	2,030	508	92	90	Good	Creamy, gray	Brown	Good	293
Average	128	57	58.5	1,865	508	90	89			do	Fair	293
13656	147	58	60.3	1,680	511	80	87	Good	Very creamy	do	Poor	295
13652	118	53	57.9	1,600	510	87	82	Fair	Creamy, gray	Pale	Fair	294

As material suitable for milling, each of the varieties was sound in every respect and absolutely free of dockage or inseparable foreign material. From a milling standpoint, contrary to the usual experience with wheat containing a high percentage of dark, hard, and vitreous kernels, a majority of the samples of hard red winter wheat varieties produced a flour soft in texture, much like the flour milled from soft red winter wheat. Of the four hard red winter varieties tested, Barleta ranked first, Record second, Ruso third, and Universal fourth.

A comparison of the data relating to the milling and baking qualities of the hard red winter wheat varieties grown in the United States and in Argentina, using the average figures for the class as an index, are as follows (the figures for the United States wheats are presented first): Test weights per bushel, 58.9 pounds, as compared with 60.7 pounds; kernel texture, 92.3 per cent, as compared with 90.8 per cent; damaged kernels, trace as compared with 0.2 per cent; flour yield, dockage-free basis, 70.1 per cent, as compared with 69.4 per cent; weight of wheat per barrel of flour, 274 pounds as compared with 278 pounds; fermentation time, 146 minutes, as compared with 129 minutes; proofing time, 59 minutes in each instance; water absorption of flour, 61.3 per cent, as compared with 59.3 per cent; loaf volume, 2,207 cubic centimeters, as compared with 2,016 cubic centimeters; weight of loaf, 511 grams, as compared with 510 grams; color score of crumb, 86, as compared with 90; score of grain of crumb, 90, as compared with 91; shade of color of crumb, creamy, as compared with creamy gray; color of crust, brown in each instance; break and shred, good in each instance; pounds of bread per barrel of flour, 295 pounds, as compared with 294.

The milling quality of three of the four varieties of soft red winter wheat tested was excellent. The flour was true to type, was of low ash content, and contained slightly more protein than is usual in straight grade soft red winter wheat flour. The variety of outstanding milling quality was Calchaqui; the varieties San Martin, Favorito, and Sin Rival ranked next in the order named.

The baking quality of the flour milled from the Argentine soft red winter wheats was somewhat weaker than that of the flour milled from the Argentine hard red winter wheats. This difference is most noticeable in the size of the loaf, the texture of crumb, color of crust, and break and shred of the loaves made from the soft wheat flours.

The soft red winter wheat varieties grown in Argentina compare favorably with varieties of the same class of wheat grown in the United States. On the basis of average figures, the yield of flour obtained from the Argentine varieties was about 1½ per cent higher than that obtained from the United States varieties—70.2 per cent, as compared with 68.6 per cent. The Argentine soft red winter wheat flour had a higher water absorption, 58.5 per cent, as compared with 55.4 per cent; a greater fermentation tolerance, 128 minutes, as compared with 112 minutes; and a better quality of the gluten in the flour, a viscosity coefficient of 2.33, as compared with 2.11. In spite of this high coefficient of gluten quality, Argentine soft wheat flour did not bake into as large a loaf of bread as the flour milled from soft wheat grown in the United States—one loaf being 269 cubic centimeters less in volume.

TABLE 28.—*Argentine export wheats: Ports of loading and unloading, and description and characteristics of samples taken at the port of unloading*

Laboratory No.	Port of loading	Crop year	Trade designation	Port of unloading	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
							Per cent	*Per cent*	*Pounds*	*Per cent*	*Per cent*
13744	Buenos Aires	1926	Baril	Hamburg, Germany	Hard red spring	3 Mixed	1.8	35.4	56.7	1.2	2.0
13399	do	1926	do	do	Hard red winter	do	1.7	65.4	56.7	1.2	.7
13402	do	1926	do	do	do	do	2.7	66.2	56.7	.4	.8
13746	do	1926	do	do	do	do	1.7	49.7	56.0	.8	2.0
13919	do	1926	do	do	do	do	1.5	50.1	56.5	.0	1.1
13344	do	1926	do	Bremen, Germany	do	4 Mixed	2.2	60.2	54.4	1.2	1.4
13331	La Plata	1926	do	do	Hard red spring	2 Northern Spring	2.3	57.8	57.7	.4	.9
	Average				Hard red winter		2.0	55.0	56.4	.7	1.3
14459	Bahia Blanca	1927	Baril	Liverpool, England	do	1 Mixed	1.9	42.4	60.2	.4	.5
14475	Buenos Aires	1927	do	Southampton, England.	Hard red spring	2 Northern Spring	1.0	41.5	61.2	1.8	.2
14474	do	1927	do	London, England	Hard red winter	2 Mixed	2.0	43.8	58.7	3.2	1.5
	Average						1.6	42.6	60.0	1.8	.7
13345	Bahia Blanca	1926	Barusso	Bremen, Germany	Hard red winter	3 Mixed	3.0	56.3	57.4	.4	2.7
13920	do	1926	do	do	do	do	1.5	53.2	58.2	.9	2.5
13922	do	1926	do	Hamburg, Germany	do	do	3.5	51.2	57.3	.4	2.1
13341	do	1926	do	do	do	do	2.9	61.5	57.4	1.0	1.0
13333	do	1926	do	Bremen, Germany	do	3 Mixed, smutty	5.6	70.4	56.3	.3	1.8
13346	do	1926	do	do	do	do	5.6	69.4	56.0	.7	2.1
13751	do	1926	do	Hamburg, Germany	do	do	3.1	46.4	57.1	1.2	2.0
13337	do	1926	do	Bremen, Germany	do	4 Mixed	2.4	40.1	58.5	.0	3.8
13336	Buenos Aires	1926	do	do	do	3 Mixed	1.1	67.2	57.5	.8	1.4
13338	do	1926	do	do	do	do	1.4	78.2	57.9	.0	1.0
13339	do	1926	do	do	do	do	1.9	67.6	56.4	1.2	1.3
13397	do	1926	do	Hamburg, Germany	do	do	2.2	59.9	57.2	.6	1.0
13349	do	1926	do	Bremen, Germany	do	do	1.2	53.6	57.7	.9	1.1
13400	do	1926	do	Hamburg, Germany	do	do	2.2	56.8	57.5	.8	1.0
13487	do	1926	do	Rotterdam, Holland	do	do	1.8	53.8	56.7	1.1	1.0
13519	do	1926	do	do	do	do	1.8	57.2	55.7	.9	.6
13743	do	1926	do	Hamburg, Germany	do	do	2.5	42.0	57.0	1.8	.7
13747	do	1925	do	do	do	do	2.0	55.2	56.9	1.0	1.3
13750	do	1926	do	do	do	do	2.2	52.8	56.2	.6	1.5
13921	do	1926	do	do	do	do	2.5	49.6	56.4	.8	1.8
13396	do	1926	do	Bremen, Germany	do	4 Mixed, smutty	1.9	65.1	54.6	2.0	.9
13401	La Plata	1926	do	Hamburg, Germany	do	3 Mixed, smutty	1.9	67.4	57.3	2.5	1.3
	Average						2.5	58.0	57.0	.9	1.5
14298	Bahia Blanca	1927	Barusso	Liverpool, England	Hard red winter	1 Mixed	.3	45.0	60.0	.7	.8
14551	do	1927	do	Avonmouth, England	do	2 Mixed	1.4	55.6	59.8	1.4	1.0

TABLE 28.—*Argentine export wheats: Ports of loading and unloading, and description and characteristics of samples taken at the port of unloading*—Continued

Laboratory No.	Port of loading	Crop year	Trade designation	Port of unloading	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
							Per cent	*Per cent*	*Pounds*	*Per cent*	*Per cent*
14253	Buenos Aires	1927	Barusso	Aalborg, Denmark	Hard red winter	2 Hard Winter	1.0	66.8	60.0	1.2	0.9
14452	do	1927	do	Copenhagen, Denmark.	do	1 Mixed	3.0	64.8	60.4	1.1	.6
14564	do	1927	do	do	do	2 Mixed	1.0	56.8	60.0	3.0	.9
14552	do	1927	do	London, England	do	do	2.2	55.4	59.0	1.3	.9
14565	do	1927	do	Copenhagen, Denmark.	do	do	2.0	63.0	58.9	1.3	1.4
14655	La Plata	1927	do	do	do	2 Hard Winter	2.5	61.2	58.4	2.2	.5
	Average						1.7	58.6	59.6	1.5	.9
13401	Diamante	1926	Entre Rios	Hamburg, Germany	Hard red winter	4 Mixed	1.2	55.0	54.8	.0	.8
13335	Buenos Aires	1926	Rosafé	Bremen, Germany	do	do	2.7	60.9	55.1	1.8	.9
13398	do	1926	do	Hamburg, Germany	do	do	1.5	49.6	54.0	1.3	.5
13749	do	1926	do	do	do	do	1.1	59.6	55.4	1.4	1.1
13388	do	1926	do	Bremen, Germany	do	do	1.0	50.1	54.0	.9	.7
13342	Rosario	1926	do	do	do	do	.7	38.4	55.3	.9	.2
13343	do	1926	do	do	do	do	1.3	45.6	54.0	.8	.4
13748	do	1926	do	Hamburg, Germany	do	do	3.0	43.8	55.0	.4	2.3
13580	do	1926	do	Hull, England	do	5 Mixed	2.4	37.2	53.5	1.3	.6
	Average						1.7	48.2	34.5	1.1	.8
14473	Rosario	1927	Rosafé	Hull, England	Hard red winter	2 Hard Winter	.9	55.8	60.4	2.0	.1
14550	do	1927	do	do	do	2 Mixed	.9	47.6	59.3	2.8	.3
	Average				do		.9	51.7	59.8	2.4	.2
14476	Rosario	1927	Rosafé	Avonmouth, England	do	2 Mixed	.9	59.8	60.1	2.4	.3
14477	do	1927	do	Cardiff, Wales	do	do	1.0	55.6	59.2	2.4	.3
14478	do	1927	do	London, England	do	do	1.0	57.4	59.8	3.4	.3
14548	do	1927	do	Avonmouth, England	do	do	1.3	61.4	58.6	1.4	.7
14485	Santa Fe	1927	do	Stockholm, Sweden	do	3 Mixed	.9	38.4	57.7	2.4	.5
	Average						1.0	54.5	59.1	2.4	.4
13558	Buenos Aires	1926	Platé	Hull, England	Hard red winter	3 Mixed	2.2	58.4	56.2	1.1	1.2
13559	do	1926	do	do	do	do	2.9	60.1	56.0	1.2	.9
13563	La Plata	1926	do	Avonmouth, England	do	do	1.8	69.1	57.0	.8	1.9
	Average						2.3	62.5	56.4	1.0	1.3

Candeal, the durum-wheat variety examined, did not prove to be a pure variety as it contained 11.9 per cent of soft red winter wheat. No doubt influenced by this admixture of soft wheat, the milling yield of this variety was low, necessitating the use of 288 pounds to yield a barrel of flour. The flour was of high ash content, was very creamy in color, and had a low protein content. Bread baked from this flour was of low quality, being deficient in volume and in color and grain of crumb.

Peruano, the variety of white wheat tested, was likewise impure, there being 32.9 per cent of soft red winter wheat kernels present. As would be expected, this did not influence the flour yield from this variety, and a high yield of flour resulted. The flour was soft in texture, creamy in color, and of a more-than-average ash content. The protein content of the flour was typical of white wheat flours. The bread baked from this flour was poor, being deficient in every factor characteristic of a good loaf of bread.

ARGENTINE EXPORT WHEATS

A large proportion of the wheat grown in Argentina is exported. These export wheats are characterized by specific trade names. Rosafé is the commercial name given to wheat grown in the regions of Rosario and Santa Fe which is shipped by way of Rosario. It is highly regarded among the South American wheats, although it is said to be of uncertain nature. Produced under climatic conditions which are fairly moist, it is semisoft in character. Barusso is Barleta or Ruso wheat shipped from the port of Bahia Blanca. It assumes a character of its own by reason of the cooler climate in which it is grown. Baril is a contraction for Barleta and Ruso. There is no special point for loading this wheat, although it is usually understood that the wheat is shipped from Buenos Aires. In general, the Argentine wheats are called Platé wheats. Entre Rios is the name given to wheat of the Province of Entre Rios. It is usually a hard wheat of good milling quality.

Fifty-nine samples of Argentine wheat, representing cargo shipments from the 1926 and 1927 crops, were received from certain European ports through the courtesy of the Superintendence Co. These samples were forwarded to the United States Department of Agriculture, where they were milled and baked in the manner heretofore described.

Ten of these cargoes represented Baril wheat, 30 Barusso wheat, 15 Rosafé wheat, 1 Entre Rios wheat, and 3 carried the general designation of Platé wheat. Sufficient of the 1926 crop arrived in good condition so that 41 milling and baking tests were made. Eighteen milling and baking tests were made on the 1927 crop.

The results of the grading tests made upon the various cargoes of Argentine wheat are found in Table 28.

As the Argentine wheat was graded it became apparent that this wheat was not uniform in kernel type. In any given sample, wheat kernels characteristic of hard red spring wheat, hard red winter wheat, soft red winter wheat, and in some instances white wheat, were found. The relative proportions of the various types of wheats depended to a large extent upon the particular commercial class of wheat under discussion. Some suggestion of the predominance of these types of kernels in the various classes will be found in the next paragraph.

Wheat of the Baril class contained a large quantity of typical hard red spring wheat. An average of 36 per cent of such wheat was found in the cargoes examined. The quantity in each cargo varied greatly, ranging from 19.6 per cent to 91 per cent. According to the samples, 8 of the 10 cargoes showed a range in the quantity of hard red spring kernels of 24.9 to 46 per cent. Baril wheat also contained considerable quantities of typical soft red winter wheat. The average quantity present was 7.4 per cent. As high as 13.9 per cent and as low as 0.5 per cent were found in the 10 cargoes examined.

Fifty-six per cent of the Baril wheat was typically hard red winter wheat. The quantity of this wheat in Baril wheat likewise varied greatly, that is, from 43.2 per cent to 90.5 per cent.

The cargoes of Barusso wheat represented by the samples, were characterized by a much higher percentage of the hard red winter types of wheat. This class of wheat, on an average, contained 77.2 per cent of typical hard red winter wheat, 14.2 per cent of typical hard red spring wheat, and 8.4 per cent of typical soft red winter wheat.

As usual, there was considerable variation in the relative proportions of each type of wheat present, as the percentage of hard red winter wheat varied from 58.9 to 96.3 per cent; the percentage of the hard red spring wheat types varied from 4.9 to 35.7 per cent; and the variation in the soft red winter wheat types was from 0.8 to 15.8 per cent. Only an occasional quantity of white wheat was found in the Barusso wheat.

An examination of the samples of the 19 cargoes of Rosafé wheat showed them to contain the greatest percentage of typical hard red winter wheat. An average of 79.9 per cent of hard red winter wheat was found in this class of wheat. Soft red winter kernels were present to the extent of 13.7 per cent, whereas the quantity of hard red spring wheat in Rosafé wheat was measurably less than in either Baril or Barusso wheat. An average of 5.8 per cent of typical hard red spring wheat was noted. A few cargoes had a trace of white wheat.

The samples of wheat from Entre Rios were insufficient to form the basis of a discussion of the relative merits of this commercial type. The one sample available for test indicated an exceptionally good cargo.

Under the United States grain standards act, wheat containing mixtures of the various classes, either singly or combined, when in excess of 10 per cent is graded as mixed wheat.

Test weight per bushel, the most reliable index of the milling quality, was decidedly low for the 1926 crop in all four commercial types examined. The average test weight per bushel of the 7 cargoes of Baril wheat was 56.4 pounds. For the 22 cargoes of Barusso wheat the test weight was 57 pounds, and for the 8 cargoes of Rosafé wheat it was 54.5 pounds. The one sample of Entre Rios wheat weighed 54.8 pounds per bushel. Under the United States standards for wheat, grain of these test weights would grade No. 3, 4, or 5. Of the 41 cargoes examined, 87 per cent graded as No. 3 wheat on account of test weight per bushel. Because of the presence of hard red spring wheat or soft red winter wheat in the samples, the designation "mixed" would have to be added to the numerical grade designation.

From a grading standpoint there does not seem to be any great difference in the quality of the two commercial types of Argentine

wheat, Baril and Barusso. According to the samples, in 1926 the Barusso wheat was slightly better, whereas in 1927 the Baril wheat was slightly superior. On the other hand, in 1926 the Rosafé wheat was not nearly so good as either the Baril or the Barusso wheat, and was slightly inferior to these commercial types of wheat in 1927.

The protein content of the wheat of the 1926 crop varied from 10.03 to 13.55 per cent. Most of the cargoes, however, had a protein content of between 10 and 11 per cent. In 1927 the protein content of the cargoes varied between 10.55 and 12.65 per cent with the majority of the cargoes containing between 11 and 12 per cent of protein.

Judged from the milling data in Table 29, Baril and Barusso wheat have about the same milling characteristics. It took 293 pounds of Baril wheat of the 1926 crop to produce a barrel of flour, as compared with 295 pounds of Barusso wheat. In 1927, the quality of the wheat was considerably better. The number of pounds of wheat of the 1927 crop necessary to make a barrel of flour from Baril wheat was 278, while for Barusso 281 pounds were required. The quality of the flour milled from both classes of wheat was very similar. If anything, the Barusso wheat produced a slightly better quality of flour, in respect to its color and protein content.

TABLE 29.—*Argentine export wheats: Milling properties of the samples described in Table 28, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.[1]	Test weight per bushel	Screenings and scourings removed	Foreign material in wheat as milled	Moisture of wheat before tempering	Flour yield— Basis cleaned and scoured wheat	Flour yield— Basis dockage-free wheat	Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour: Visual	Color of flour: Gasoline value	Ash in flour	Acidity of wheat as— pH	Acidity of wheat as— Lactic acid	Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	
13744	56.7	4.3	0.1	11.2	68.9	67.1	284	Semihard	Granular	White	1.10	0.55	6.33	0.394	10.03	9.55	2.41
13399	57.2	4.2	.3	12.3	66.7	65.1	297	Soft	Soft	do	1.10	.42	6.42	.408	10.51	9.74	2.42
13402	56.2	4.3	.5	12.0	68.4	67.3	286	do	do	do	1.04	.50	6.45	.326	10.22	9.57	2.61
13746	56.6	5.4	1.1	10.8	66.8	64.3	296	Semihard	Granular	do	1.23	.47	6.41	.386	10.85	10.32	2.55
13919	56.4	4.0	.6	10.2	67.9	66.2	285	Soft	Soft	do	1.27	.47	6.43	.327	10.67	9.85	2.20
13344	54.8	4.4	.6	11.7	62.7	61.3	313	do	do	do	.99	.44	6.35	.349	10.40	9.16	2.75
Average	56.3	4.4	.5	11.4	66.9	65.2	294	do	do	do	1.12	.48	6.40	.365	10.45	9.70	2.46
14459	61.4	3.3	.2	11.2	68.6	67.6	282	Semihard	do	do	.76	.46	6.52	.293	10.55	9.93	2.30
14475	62.0	2.5	.0	12.5	72.7	71.6	271	do	Granular	do	.77	.50	6.54	.335	10.76	9.76	2.19
14474	59.3	3.8	.5	12.2	70.0	68.7	281	Soft	Soft	do	.93	.57	6.57	.352	11.38	10.99	2.35
Average	60.9	3.2	.2	12.0	70.4	69.3	278	Semihard	do	do	.82	.51	6.54	.327	10.90	10.23	2.28
13345	57.8	5.3	2.3	11.9	66.0	64.5	299	Soft	do	do	1.09	.52	6.30	.336	11.36	10.28	2.37
13920	58.9	4.7	1.9	10.7	69.6	67.3	282	Semihard	Granular	do	1.40	.52	6.40	.325	10.67	10.13	2.16
13922	58.5	7.2	1.5	10.6	69.4	65.5	285	do	do	do	.78	.46	6.37	.256	10.51	9.99	2.18
13341	58.1	4.5	.6	12.1	63.0	61.9	312	Soft	Very soft	do	.93	.47	6.36	.346	11.45	10.45	2.46
13346	57.9	4.5	1.7	11.6	65.3	64.3	298	do	Soft	Dark gray	.92	.59	6.03	.355	12.03	10.98	2.66
13751	57.9	2.6	1.7	10.7	68.0	67.2	282	Semihard	Granular	White	1.38	.55	6.12	.310	11.20	10.41	2.24
13397	57.0	4.4	.7	12.2	65.5	64.0	302	Soft	Soft	Slightly creamy	1.00	.46	6.28	.377	10.99	10.12	2.42
13340	57.9	3.0	.7	11.9	64.2	63.0	305	do	Very soft	White	1.09	.42	6.41	.376	10.18	8.93	2.46
13400	57.6	4.2	.7	12.5	69.1	67.7	286	do	Soft	Slightly creamy	.90	.53	6.42	.368	10.65	9.62	2.50
13487	57.4	4.5	.5	13.2	68.7	66.8	292	Semihard	Granular	White	.90	.45	6.44	.316	10.65	9.73	2.33
13519	55.6	4.1	.2	13.5	67.1	65.4	300	do	do	do	1.20	.44	6.32	.270	11.06	10.41	2.02
13743	57.9	1.8	.2	11.2	67.5	64.9	294	do	do	do	1.07	.50	5.94	.384	10.97	10.38	2.21
13747	56.9	4.1	1.1	10.7	66.4	65.0	292	do	do	do	1.15	.52	6.28	.363	11.05	10.27	2.15
13750	57.1	5.9	.7	10.9	66.3	63.8	298	do	do	do	1.19	.54	6.30	.....	11.70	10.23	2.24
13921	56.5	7.5	1.0	10.2	65.9	62.5	302	do	do	do	.98	.47	6.41	.323	10.99	10.04	2.41
13396	55.5	3.8	.5	10.6	66.1	64.8	293	Soft	Soft	Creamy	1.24	.51	6.26	.425	10.67	10.03	2.42

13401	58.0	4.6	.4	12.0	68.9	67.0	288	do	do	White	.95	.55	6.42	.368	12.35	11.28	2.63
Average	57.4	4.5	1.0	11.6	66.9	65.1	295	Semihard	Granular	do	1.07	.50	6.30	.344	11.09	10.19	2.34
								do	do	do	1.15	.47	6.38	.474	11.36	10.64	2.11
14208	61.2	2.4	.6	12.5	70.7	66.1	293	Soft	Soft	Slightly creamy	1.07	.46	6.62	.278	11.64	10.76	2.73
14551	60.6	3.9	.7	12.4	69.8	68.0	285	Semihard	Granular	White	.70	.49	6.63	.307	11.79	11.06	2.45
14452	61.3	4.0	.2	11.1	69.9	69.2	276	do	do	Slightly creamy	1.01	.51	6.52	.295	10.58	9.35	2.35
14564	60.6	2.4	.3	11.9	70.7	69.7	276	Soft	Soft	do	.99	.48	6.62	.307	11.73	10.93	1.96
14552	60.4	3.8	.5	12.5	70.7	69.5	278	do	do	Creamy	1.01	.56	6.51	.341	12.24	11.11	2.11
14565	59.6	3.5	.9	11.3	69.4	68.3	281	do	do	White	1.05	.57	6.43		12.05	11.74	1.94
14655	59.8	4.4	.1	12.0	70.3	69.0	279	Semihard	Granular	Light creamy	1.00	.51	6.53	.334	11.71	10.80	2.24
Average	60.5	3.5	.5	12.0	70.2	68.5	281	do	do								
13404	55.5	4.7	.2	12.2	66.9	64.2	301	Soft	Soft	White	1.06	.43	6.40	.306	13.55	12.69	2.25
								do	do	Slightly creamy	1.29	.44	6.28	.333	11.08	9.96	2.44
13368	54.3	4.0	.1	12.5	63.9	62.3	311	Semihard	Granular	White	1.12	.52	6.34	.377	11.38	9.36	2.50
13749	56.1	3.4	.2	10.3	65.4	63.9	297	do	do	do	1.18	.51	6.32	.356	10.66	10.01	2.25
13388	54.4	4.4	.2	11.8	66.6	64.3	299	do	do	do	1.02	.43	6.30	.386	10.72	9.44	2.37
13342	55.3	3.2	.0	11.8	59.6	58.1	339	Soft	Very soft	do	.95	.44	6.30	.381	10.78	9.59	2.49
13343	54.2	3.9	.0	11.5	59.5	58.0	330	do	do	do	1.09	.49	6.41	.295	10.52	9.54	2.39
13560	54.1	5.2	.2	12.1	66.3	64.4	300	Semihard	Granular	do	1.11	.47	6.32	.356	10.86	9.65	2.41
Average	54.7	4.0	.1	11.8	63.6	61.8	311	Soft		do	.96	.52	6.63	.296	12.20	11.26	2.47
14476	61.2	1.8	.2	12.2	69.5	68.9	280	Semihard	Granular	do	.98	.47	6.60	.296	12.20	11.60	2.26
14477	59.8	2.5	.1	12.2	66.6	65.6	294	Soft	Soft	do	.98	.49	6.58	.315	12.04	11.04	2.34
14478	60.4	2.4	.1	12.1	68.6	67.7	285	do	do	do	1.02	.58	6.64	.306	12.84	11.88	1.85
14548	59.5	2.6	.1	12.5	68.0	67.0	289	do	do	Slightly creamy	.94	.46	6.57	.330	10.97	9.91	2.03
14485	59.0	2.6	.0	11.2	66.5	65.3	292	do	do	White	.97	.50	6.60	.309	12.05	11.02	2.19
Average	60.0	2.4	.1	12.0	67.8	66.9	288	do	do	do	1.10	.52	6.50	.309	10.80	9.90	2.20
13558	56.5	5.0	.5	12.6	68.5	66.6	291	Semihard	Granular	do	1.07	.50	6.51	.307	10.49	9.69	2.46
13559	56.1	4.8	.4	12.1	67.7	66.1	291	do	do	do							
Average	56.3	4.9	.4	12.4	68.1	66.4	291	do	do	do	1.08	.51	6.50	.308	10.64	9.80	2.33
14473	61.1	2.0	.0	12.1	69.0	68.2	283	Soft	Soft	do	.96	.54	6.60	.347	11.96	11.15	2.38
14550	59.9	2.1	.3	12.6	68.8	68.0	285	do	do	Slightly creamy	.91	.47	6.60	.317	11.44	10.19	2.17
Average	60.5	2.0	.2	12.4	68.9	68.1	284	do	do	Light creamy	.94	.50	6.60	.332	11.70	10.67	2.28

[1] Samples 13333, 13334, 13335, 13336, 13337, 13338, 13339, 13348 and 13563 were too small for milling and were not included in computing the averages in this table.

TABLE 30.—*Argentine export wheats: Baking properties of the samples described in Tables 28 and 29*

Laboratory No.[1]	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13744	146	60	56.7	1,990	497	89	90	Good	Light creamy, gray	Brown	Fair	287
13399	121	64	56.0	2,250	491	86	91	do	do			283
13402	118	62	57.4	2,120	500	87	91	do	Creamy, gray			288
13746	150	60	56.0	2,140	499	88	90	do	do	Brown	Fair	288
13919	136	57	54.5	2,000	494	90	89	Fair, crumbly	Light creamy	Light brown	Poor	285
13344	110	59	54.7	2,100	498	87	92	Good, crumbly	Creamy			287
Average	130	60	55.9	2,100	496	88	90	Good	Creamy	Brown	Fair	286
14459	140	67	56.4	1,940	492	90	89	Good	Light creamy	Brown	Good	284
14475	137	55	54.6	1,960	475	89	91	Fair	Creamy	do	Poor	274
14471	151	64	53.5	2,370	480	90	90	Good, crumbly	Creamy, gray	do	Good	277
Average	143	62	54.8	2,090	482	90	90	Good	Creamy	Brown	Fair	278
13345	117	63	56.2	2,230	493	85	92	Good	Creamy, gray		Fair	284
13920	137	61	54.5	2,060	496	90	90	Fair	Light creamy	Brown		282
13922	137	62	54.4	2,130	490	91	90	Fair, crumbly	Light creamy, gray	do	Poor	282
13341	114	65	54.9	2,260	502	84	94	Good	Creamy, gray			289
13346	107	56	54.5	2,140	500	83	91	do	Cocoa brown			288
13751	128	62	55.1	2,240	490	81	90	Fair, crumbly	Creamy, gray (smutty)	Brown	Good	282
13397	127	62	55.9	2,170	498	89	92	Good	Light creamy, gray			287
13340	116	65	56.0	2,170	506	86	91	do	Creamy, gray			291
13400	114	62	57.9	2,200	503	87	91	do	Light creamy, gray			290
13487	127	59	56.7	2,110	501	80	92	do	Gray (smutty)			289
13519	131	62	56.9	2,250	497	88	91	do	Light creamy, gray			287
13743	146	64	58.7	2,280	503	89	92	Excellent	Light creamy	Brown	Fair	290
13747	146	61	58.1	2,220	501	90	92	do	Creamy	Light brown	do	289
13750	141	61	57.2	2,210	498	88	90	Good	do	do	do	287
13921	139	59	54.7	2,100	485	91	91	Good, crumbly	Light creamy	do	do	281
13396	129	64	55.4	2,170	497	87	90	Good	Creamy, gray			287
13401	121	61	56.7	2,340	503	83	92	do	Light creamy (smutty)			290
Average	128	62	56.1	2,193	498	87	91	Good	Creamy		Fair	287
14298	117	63	54.1	2,110	491	87	88	Fair	Light creamy, gray	Light brown	do	283
14551	152	69	55.4	2,150	488	88	92	Good	Creamy, gray	Brown	Good	281
14452	146	68	58.6	2,220	498	90	90	Fair, crumbly	Light creamy	do	Fair	287
14564	146	68	56.3	2,080	493	87	89	Good, crumbly	Creamy	Light brown	Good	284

14552	163	62	55.7	2,130	493	88	92	Good	Creamy, gray	Brown	do	284
14565	148	56	56.3	2,010	502	84	88	Fair, crumbly	do	do	Fair	289
14055	151	60	57.0	2,260	491	86	89	Good, crumbly	Light creamy, gray	Light brown	Good	283
Average	146	64	56.2	2,137	494	87	90	Fairly good	Creamy	Brown	Fairly good	284
13404	121	59	55.7	2,510	495	89	94	Excellent	Light creamy-gray			285
13398	118	61	56.5	2,300	502	90	92	Good	do			289
13749	142	61	56.6	2,030	498	85	90	Good, crumbly	Very creamy	Light brown	Good	287
13388	114	57	57.1	2,090	503	86	91	Good	Creamy			290
13342	113	63	53.8	2,290	493	89	94	Excellent	do			284
13343	113	65	53.6	2,340	490	89	93	do	do			282
13560	132	59	55.7	2,210	498	87	93	do	Creamy-gray	Brown	Fair	287
Average	122	61	55.6	2,210	497	88	92	Very good	Creamy			286
14476	144	63	57.9	2,150	497	89	90	Excellent	Light creamy	Brown	Fair	287
14477	153	66	56.7	2,300	489	88	90	Good	do	do	do	282
14478	157	61	57.0	2,220	497	89	90	do	do	do	do	287
14548	156	60	58.2	2,100	490	86	90	Good, crumbly	Creamy, gray	Foxy brown	do	282
14485	128	63	54.0	2,060	491	89	89	do	Light creamy, gray	Brown	do	283
Average	148	62.6	56.8	2,166	493	88	90	Good	Light creamy	do	do	284
14473	159	68	56.3	2,240	493	89	90	do	Creamy, gray	do	Good	284
14550	156	66	56.1	2,210	490	90	92	do	Light creamy	do	do	282
Average	158	67	56.2	2,226	492	89	91	Very good	Creamy	do	Fair	283
13558	142	60	54.2	2,080	493	87	90	Good	Creamy, gray	do	do	284
13559	142	60	53.9	2,060	495	86	90	do	do	do	Good	285
Average	142	60	54.0	2,070	494	86	90	do	do	do	Fairly good	284

[1] See footnote to table 29.

The Rosafé wheat of the 1926 crop was decidedly low in milling quality. On an average basis, 311 pounds of Rosafé wheat were necessary to produce a barrel of flour. In certain cargoes 330 pounds were needed for this purpose. In 1927 the quality of Rosafé wheat was much better, but it was not the equal of Baril or Barusso wheat of either crop year.

There was little difference in the baking quality of the flour milled from Baril, Barusso, or Rosafé wheats of the 1926 crop. (Table 30.) There was slightly more uniformity in the quantity of bread that could be baked from a given unit of Baril flour, and the dough of Baril flour had slightly greater fermentation tolerance than the flour milled from either Barusso or Rosafé wheat, but except for these two points no marked differences in baking quality were noted. The bread baked from the flour milled from the 1927 crop was of about the same quality as that baked from the 1926 crop; the yield of bread, however, was slightly less than that obtained from the flours milled from the 1927 crop.

Judged as to baking quality, the Argentine wheats can not be considered as strong wheats, as the flour milled from them is lacking in strength. On this account they would not be able to "carry" any weaker wheats in a mill mix. On the other hand, they appear to be good filler wheats, as they need but little help from stronger wheats.

As compared with the hard red winter wheats exported from the United States (average values for the two series of samples described in Tables 19 to 24, inclusive) the average quality of the 1926 Argentine crop, all three commercial classes considered, was of the following order (the values for the United States export wheat being given first): Dockage, 0.6 per cent, as compared with 2.2 per cent; kernel texture, 54.9 per cent, as compared with 55.8 per cent; test weight per bushel, 60 pounds, as compared with 56.3 pounds; damaged kernels, 1.1 per cent, as compared with 0.8 per cent; foreign material other than dockage, 1.2 per cent, as compared with 1.3 per cent; flour yield, 70 per cent, as compared with 64.6 per cent; pounds of wheat necessary to produce a barrel of flour, 271 pounds, as compared with 298 pounds; ash content of flour, 0.52 per cent, as compared with 0.49 per cent; crude protein of wheat, 10.87 per cent, as compared with 10.97 per cent; crude protein of flour, 9.96 per cent, as compared with 10.07 per cent; gluten quality index, 2.23, as compared with 2.37.

As stated above, the grading and milling quality of the Argentine crop was considerably better in 1927 than in 1926, but it was not equal to that of the United States export wheats.

A study of the baking quality of the wheats under discussion reveals the following comparisons (the values of the United States export samples being stated first): Fermentation time, 138 minutes, as compared with 128 minutes; proofing time, 64 minutes, as compared with 60 minutes; water absorption of flour, 57.9 per cent, as compared with 55.8 per cent; volume of loaf, 2,144 cubic centimeters, as compared with 2,181 cubic centimeters; weight of loaf, 502 grams, as compared with 497 grams; color score of crumb 86, as compared with 87; texture score of crumb, 91 in both instances; pounds of bread per barrel of flour, 289, as compared with 286 pounds.

CHILE

The agricultural area of Chile is divided into three sections—northern, central, and southern. The northern section includes the Provinces of Coquimbo and Aconcagua; the central section comprises the territory between Santiago and Concepcion; and the southern section includes all the lands south of the Bio-bio River. Wheat is grown in all three sections, but chiefly on the land that lies along the coastal range and extends eastward to the foot of the Andes and extends between the thirty-third and forty-second degrees of south latitude. In the northern Provinces, where the temperature is warm, cultivation of wheat is dependent upon the availability of irrigation water. In the south, and on the island of Chiloe, excessive rains become the limiting factor of production. Plant disease, rust and smut, high winds, and excessive humidity also exert considerable influence upon the production of wheat in Chile.

In 1923–24 the largest acreage of wheat occurred in the Provinces of Malleco, Bio-bio, Ñuble, Cautin, and Llanquihue, in the order named. The production of wheat for the crop years 1924–25 to 1927–28 averaged 26,000,000 bushels. A small portion of this wheat finds its way into the export trade.

White wheat is the predominating class of wheat grown in Chile. Durum wheat, on account of its resistance to drought, high temperature, and plant disease, is grown to a small extent in the northern zone, particularly in the Province of Atacama. Production of durum wheat does not exceed 5 per cent of the crop.

In the central and southern zones common white wheats predominate. In the central zone, which is the commercially important zone, the common white wheats are cultivated. The more important varieties are Australiano, Florence, Oregon, and Richelle de Nápoles. In the southern zone, on account of their resistance to excessive rains, the white club (*Triticum compactum*) and red winter varieties are the important types. Prominent varieties are Linaza and Colorado de Traiguen.

Through the courtesy of Dr. Alberto Wiedmaier, Director of l'Estacion Experimental de la Sociedad Nacional de Agricultura Santiago, Santiago, Chile, samples of the varieties Australiano, Florence, Oregon, and Richelle de Nápoles were received for study. In transmitting the samples the following data relative to the importance and distribution of the varieties were appended.

The variety Australiano originated in Chile. Its area of cultivation extends from the Province of Aconcagua to Concepcion. It is of winter habit of semilate maturity, but is not resistant to red rust. On this account its cultivation is restricted.

The variety Oregon is of Australian origin. It was introduced into Chile in 1873 under the name Orange White Lammas. Its original qualities have changed so favorably that it can be considered as a Chilean variety. It is a winter wheat, a good yielder, but unfortunately is not resistant to rust. For this reason the cultivation of this variety has been greatly reduced in recent years. Its distribution is similar to that of Australiano.

The variety Richelle de Nápoles is a recent introduction into Chile. Its area of cultivation extends from the Province of Coquimbo to the Province of Cautin. It is said to be resistant to red rust, to produce well, and to be of good milling quality.

Florence is cultivated more than any other variety in Chile. It is grown principally in the central and north central zones, from the Provinces of Coquimbo to Concepcion. It is reported to be very resistant to rust and to produce grain of excellent milling qualities. A grave defect of this wheat is its inability to tiller; and as it is of spring habit, acre yields are not so large as are those from the white winter varieties.

The results of the grading, milling, and baking tests made on the varieties of wheat grown in Chile are found in Tables 31, 32, and 33.

TABLE 31.—*Wheats grown in Chile: Description and characteristics of the variety samples*

Laboratory No.	Province where grown	Designation	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					P. ct.	*P. ct.*	*Lbs.*	*Gms.*	*P. ct.*	*P. ct.*
14226	Santiago	Florence	White	1 Hard White	0	82.5	63.5	5.1	0.0	0
14228	do	Australiano	do	1 Soft White	0	42.7	63.0	5.4	.5	0
14227	do	Oregon	do	do	0	14.0	60.8	5.1	.1	0
14229	do	Richelle de Nápoles	do	2 Soft White	0	4.4	59.8	5.2	.0	0

TABLE 32.—*Wheats grown in Chile: Milling properties of the variety samples described in Table 31, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour	
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*				
14226	64.6	1.3	13.0	76.4	75.4	258	Semihard	Soft	White	0.80
14228	64.0	1.2	11.9	72.0	71.1	271	Soft	do	do	1.80
14227	61.0	.9	12.9	71.7	71.1	274	do	Very soft	do	1.43
14229	60.5	1.7	12.1	71.3	70.0	276	Very soft	do	do	1.46

Laboratory No.	Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
			pH	Lactic acid							
	Per cent	*Per cent*		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	
14226	0.48	1.45	6.44	0.490	11.40	10.67	3.43	5.71	9.14	37.53	2.26
14228	.60	1.70	6.43	.542	7.21	6.29	2.11	2.67	4.78	44.14	2.85
14227	.52	1.77	6.37	.451	8.27	7.18	2.25	3.58	5.83	38.59	2.78
14229	.51	1.66	6.44	.509	7.59	6.72	2.06	3.24	5.30	38.87	2.88

TABLE 33.—*Wheats grown in Chile: Baking properties of the variety samples described in Tables 31 and 32*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*P. ct.*	*C. c.*	*Gm.*	*Score*	*Score*					*Lbs.*
14226	105	62	61.6	2,290	511	90	92	Good	Light creamy	Brown	Fair	295
14228	109	61	56.3	1,640	497	84	65	Poor	Very creamy	Pale	Poor	287
14227	106	66	55.1	1,840	500	86	78	Fair	Creamy	do	do	288
14229	99	60	53.9	1,590	484	88	52	Poor	do	do	do	279

Without question, the variety Florence was of outstanding milling quality, as the sample showed that it is possible to produce a barrel of flour with as little as 258 pounds of wheat. The milling quality of the varieties Australiano and Oregon was very good. The milling quality of the variety Richelle de Nâpoles, although not of such a high level, was good.

From a baking standpoint, only the flour from the variety Florence was of excellent baking quality. The flour milled from the other three varieties all exhibited outstanding weaknesses in baking strength.

URUGUAY

The area now devoted to wheat production in Uruguay is very small in proportion to the total agricultural area, although it has shown a moderate increase since prewar times. The average production of wheat in Uruguay for the crop years 1924–25 to 1928–29 averaged 12,000,000 bushels.

The climate of Uruguay is not especially adapted to the growing of wheat. Rains are frequently excessive at seeding time, during May and June, and are often deficient when the crop is reaching maturity, in October and November. Large production losses are occasioned by rust and high winds. Excessive heat in the northwestern part of the wheat section is likewise a limiting factor in wheat production.

In Uruguay hard red spring type of wheats predominate. Some durum wheat is grown in the northern part of the wheat section. White wheat and club wheats are not grown in Uruguay.

The variety Pelon is most widely grown. This variety is similar to the Argentine variety Favorito. As with Favorito, less acreage is sown to Pelon each year on account of its inferior milling and baking qualities. Pelon is of spring habit and must be sown early to insure the best results.

Artigas and Larranaga, two varieties which have recently been distributed by the Institute Fitotecnico y Semillero Nacional La Estanzuela, are being sown on a larger scale on account of their high yielding qualities and good milling characteristics. Both of these varieties are of spring habit.

In the Department of Paysandu the varieties Rieti and Barleta are sown on account of their resistance to rust and to shattering. The variety L'Americano, a mixture of Rieti and Barleta, is likewise grown extensively because of its hardiness and good yielding qualities.

Variety names are not available for the durum wheats.

Samples of several of the varieties just described were obtained through the courtesy of G. J. Fischer, subdirector of the Institute Fitotecnico y Semillero Nacional La Estanzuela. Milling and baking tests were made upon them in the manner heretofore described. The names of the varieties tested as well as the data obtained are found in Tables 34, 35, and 36.

TABLE 34.—*Wheats grown in Uruguay: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					P. ct.	*P. ct.*	*Lbs.*	*Gm.*	*P. ct.*	*P. ct.*
15066	Agricultural Experiment Station, La Estanzuela.	Artigas 123	Hard red spring.	1 Hard Spring	0	97.8	63.3	3.8	0.6	0
14123	(1)	Artigas	do	1 Dark Northern Spring.	0	98.2	58.8	2.9	.2	0
15064	Agricultural Experiment Station, La Estanzuela.	Pelon 33 c	do	do	0	92.6	59.7	2.7	.6	0
15065	do	IV c 100 Larranaga.	do	3 Dark Northern Spring.	.	92.1	63.3	4.5	5.1	0
15063	do	Duro 1048	Durum	1 Amber Durum	0	78.2	63.3	4.3	.1	0
15061	do	Duro 106 b	do	3 Amber Durum	0	99.7	60.3	3.5	4.6	0
15062	do	Duro 106 d	do	do	0	97.4	59.2	3.8	5.4	0

[1] Not stated.

TABLE 35.—*Wheats grown in Uruguay: Milling properties of the variety samples described in Table 34, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour	
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*				
15066	61.2	0.9	11.5	71.6	71.0	270	Soft	Very soft	White	1.15
14123	59.9	1.5	10.0	67.5	66.5	283	do	do	do	.89
15064	60.9	1.0	11.7	73.5	72.7	264	do	do	do	1.58
15065	64.5	1.0	12.0	73.9	73.2	263	do	do	do	1.01
15063	63.4	1.7	11.5	76.3	75.4	261	Very hard	Granular	Creamy	1.92
15061	60.3	1.7	11.4	69.4	68.2	281	do	do	do	1.82
15062	59.4	1.6	11.2	69.5	68.4	279	do	do	Very creamy	2.25

Laboratory No.	Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten in flour	Gliadin in flour	Gluten protein in flour	Gluten in in gluten proteins	Gluten quality index (Gertner angle b)
			pH	Lactic acid							
	Per cent	*Per cent*		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	
15066	0.53	1.53	6.67	0.225	12.21	11.28	3.79	5.85	9.64	39.32	2.08
14123	.51	1.66	6.64	.207	11.47	10.56	3.64	5.40	9.04	37.59	2.24
15064	.51	1.74	6.73	.274	10.45	9.61	3.18	5.05	8.23	38.63	2.80
15065	.41	1.64	6.63	.302	11.99	10.80	3.39	5.90	9.29	36.49	1.93
15063	.79	1.65	6.70	.300	10.44	10.02	3.39	5.17	8.56	39.60	2.80
15061	.81	1.85	6.68	.342	13.85	13.70	4.77	6.98	11.75	40.59	2.68
15062	.94	1.85	6.64	.381	13.96	13.45	4.80	6.74	11.54	41.59	3.18

TABLE 36.—*Wheats grown in Uruguay: Baking properties of the variety samples described in Tables 34 and 35*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*P. ct.*	*C. c.*	*Gm.*	*Score*	*Score*				*Lbs.*
15086	170	65	61.1	1,990	506	88	90	Light creamy	Brown	Fair	291
14123	125	59	56.0	2,000	501	88	91	Creamy	Light brown	Poor	289
15084	156	63	56.7	1,780	491	85	96	do	do	do	283
15085	158	73	60.7	2,060	507	90	88	Light creamy	Brown	Fair	292
15083	150	67	63.6	1,600	520	86	85	Very creamy	Foxy brown	Poor	300
15081	157	58	69.7	1,970	515	85	88	do	do	do	297
15082	160	62	70.8	1,700	541	82	84	Very, very creamy	do	Very poor	312

Four of the varieties were classified as hard red spring wheats, and three were classified as durum wheats. The wheat of the durum varieties was considerably damaged, presumably at harvest time. Three of the hard red spring wheat varieties—Artigas 123, Pelon, and Larranaga—were of excellent milling quality. The other hard red spring variety, Artigas, was of noticeably lower milling quality. Among the durums, the variety Duro 1048 was of outstanding milling quality; the other two were of questionable milling quality.

As far as baking quality is concerned, the same order of merit does not obtain among the varieties with either class of wheat. Whereas the hard red spring variety Artigas 123 was of the best milling quality, the flour from the variety Larranaga had the best baking quality, followed in order by the varieties Artigas, Artigas 123, and Pelon. Among the durum wheats, only the flour milled from the variety Duro 106 b was of good baking quality. The flour from the other varieties produced more bread per barrel of flour, but the quality of the loaf was distinctly inferior.

Uruguay exports some wheat, which, in the world markets is usually recognized and graded as Baril wheat. The milling and baking qualities of the export wheats of Uruguay are similar to Argentine wheat of the Baril type.

MILLING AND BAKING QUALITIES OF EUROPEAN WHEATS

Production of wheat in all Europe is considerably greater than the amount grown in North America. The production during the crop year 1927–28, exclusive of Russia, was 1,413,000,000 bushels, whereas for North America the figure was 1,447,000,000 bushels.

In Europe wheat is grown in 29 different countries. The milling and baking qualities of the wheat grown in 22 of these countries are discussed below.

BELGIUM

Wheat production in Belgium is not extensive. From 12,000,000 to 18,000,000 bushels of wheat are raised annually. This is not sufficient for domestic consumption, and it is necessary to import from 40,000,000 to 45,000,000 bushels, depending upon the size of the domestic crop.

The production of wheat is influenced markedly by climate, soil, and relief. The winters are very irregular; the occurrence of much

alternate freezing and thawing is very damaging to the wheat plants, especially on the shallow soils. Heavy freezes sometimes kill the plants, so that fields must be resown.

Cold-air currents in the Ardennes in southwest Belgium have such an important effect upon wheat that it is often replaced by spelt, which is more winter-resistant. On the other hand, hot winds frequently damage wheats on sandy soils, especially in the districts of Condroz and Jurassique. Spring wheat is frequently seriously damaged by long drought.

According to the International Institute of Agriculture, the white wheats Wilhelmina and Double Stand Up are extensively grown in Belgium, especially on the rich soils of Flanders. Wilhelmina, Double Stand Up, and Reliance, make up about 62 per cent of the wheat grown. The following varieties make up the remainder: Descat de Carter, 20 per cent; Pansar, 3 per cent; Dattel, 3 per cent; Champion and Grenadier, 1 per cent; and all others 6 per cent.

Belgian wheats are of winter habit. They are sown from September to December, depending upon the altitude. Harvesting usually begins in August.

Through the courtesy of the director of la Station d'Amelioration des Semences de l'Etat, at Gembloux, Belgium, samples of the following six varieties were received: Champion, Hybride de la Station, Hybride du Tresor, Millioen, Wilhelmina, and a local variety. No information was supplied relative to the importance and distribution of these varieties. Only two of the wheats mentioned by the International Institute of Agriculture as being important in Belgium are included in the group tested. Three of the varieties—Wilhelmina, Millioen, and Hybride de la Station—are white wheats; the other three varieties are soft red winter wheats.

The results obtained from the samples milled and baked in the manner heretofore described are given in Tables 37, 38, and 39.

TABLE 37.—*Wheats grown in Belgium: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					P. ct.	*P. ct.*	*Lbs.*	*Gm.*	*P. ct.*	*P. ct.*
15245	Agricultural Experiment Station, Gembloux.	Local variety	Soft red winter.	1 Red Winter.	0.5		60.2	4.9	0.5	0
15244	do	Hybride du Tresor.	do	2 Red Winter.	.2		58.4	4.9	1.0	0
15243	do	Champion	do	4 Red Winter.	.0		57.1	4.9	7.4	0
15247	do	Hybride de la Station.	White	2 Soft White.	.5	22.0	59.2	5.0	2.2	0
15248	do	Wilhelmina	do	do	.0	54.2	58.0	4.2	1.5	0
15246	do	Millioen	do	3 Soft White.	.9	63.0	57.0	4.6	2.8	0

TABLE 38.—*Wheats grown in Belgium: Milling properties of the variety samples described in Table 37, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour	
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*				
15243	61.2	2.2	9.8	71.9	70.7	266	Soft	Soft	White	0.66
15244	58.4	2.5	9.8	71.1	69.4	271	Very soft	Very soft	do	.93
15243	58.0	4.4	10.0	69.0	66.8	282	Soft	do	do	1.46
15247	59.2	3.0	9.2	71.5	69.7	268	do	do	do	1.17
15248	59.7	2.5	9.8	70.1	68.3	275	do	do	do	1.79
15246	58.2	3.5	10.0	71.5	69.0	271	do	Soft	do	1.09

Laboratory No.	Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Gluten-in in gluten proteins
			pH [1]	Lactic acid						
	Per cent	*Per cent*		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
15245	0.47	1.67		0.344	9.66	9.18	2.84	3.86	6.70	42.39
15244	.51	1.66		.341	8.23	7.28	2.56	3.21	5.77	44.37
15243	.58	1.63		.455	9.38	8.16	3.09	3.36	6.45	47.91
15247	.52	1.69		.446	9.28	8.26	2.84	3.79	6.63	42.84
15248	.52	1.62		.412	8.23	7.16	2.68	3.01	5.69	47.10
15246	.59	1.70		.417	8.42	7.54	2.61	3.02	5.63	46.36

[1] No determinations made on account of naphthalene in samples.

TABLE 39.—*Wheats grown in Belgium: Baking properties of the variety samples described in Tables 37 and 38*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
15245	140	51	59.1	1,650	503	89	81	Very poor, crumbly	Creamy gray	Very pale	Very poor	290
15244	125	51	54.4	1,580	488	86	77	do	do	do	do	281
15243	124	46	55.2	1,640	496	79	77	Very poor, very crumbly	Creamy dark gray	do	do	280
15247	123	50	54.8	1,600	492	82	74	Very poor, crumbly	Creamy	do	do	284
15248	124	49	54.6	1,520	484	80	72	do	Very creamy	do	do	279
15246	119	50	55.8	1,660	491	84	79	do	Creamy	do	Poor	283

With but one exception, a large yield of flour was obtained from all the varieties of Belgian wheat tested. This is true in spite of the relatively low test weight per bushel of the varieties of wheats involved. The flour produced was of good color, of a slightly high ash content, but of a low protein content. The water absorption of the flour milled from the soft red winter wheat varieties averaged 56.2 per cent; this is an average value for the soft red winter wheat flours of American origin. The water absorption of the white wheat flours tested averaged 55 per cent; this value is somewhat low in comparison with the value that is usually associated with flours of a similar class milled from wheats grown in North America.

As with the soft white wheats of continental Europe, the Belgian flours lacked strength. Loaves of bread baked from the Belgian flours of both classes of wheats were small in volume and coarse in texture. From the color of the loaf it was apparent that these flours, in addition to being low in protein content, were deficient in diastatic activity. Blending these varieties with strong wheats appears to be the best way of improving the baking quality of Belgian flours.

BULGARIA

The acreage of wheat in Bulgaria is slightly above the pre-war level, and production has increased rapidly. As compared with the pre-war average (1909–1913) production of 37,823,000 bushels, the estimated production in 1928, was 50,691,000 bushels. Exports are variable, seldom exceeding 4,000,000 bushels annually. The principal wheat-producing sections of Bulgaria are Burgas in the eastern part and Stara Zagora in the central part. The greatest territory of surplus production is in the north along the Danube River opposite the great wheat districts of Rumania. Winter wheat predominates, but spring, durum, and white wheats are grown.

The characteristic climatic factors limiting the production of wheat are autumn drought and winter freezing, especially in the mountainous sections and in the interior of the Danubian plain. In the spring, droughts in April and May are the most harmful factors. During the summer, excess heat and hot winds are damaging factors.

In the Danubian section, drought is the most damaging. Winter freezing, rust, and scalding are common, especially in the eastern coastal section.

In the interior comprising all the mountainous western sector and the southwestern sector, drought and winter adversities cause the most damage to the crop. In the neighborhood of Maritsa, drought and excess heat are the outstanding adverse factors.

Through the cooperation of the department of plant breeding of the University of Sofia at Sofia, Bulgaria, samples of seven of the most important wheat varieties grown in Bulgaria were obtained for study. Two of these varieties were durum wheats; three, soft red winter wheats; one, a hard red winter wheat; and one, a white wheat. With the exception of spring wheat, which occupies an acreage of minor importance, the wheats of Bulgaria are of winter habit.

The durum variety Zagaria was grown in the Department of Stara Zagora, in the south central part of Bulgaria. This variety is of winter habit and is said to be representative of all the durum wheat grown in Stara Zagora. The sample of the variety Red-awned Zagaria was grown at the agricultural experiment station at Sadovo, in southern

Bulgaria. It is representative of the durum wheat grown to a limited extent in southern Bulgaria.

Two of the soft winter wheat varieties were not named. The sample of the third, Tchervenoclassa Tchervenca No. 16, was grown at the agricultural experiment station at Obrastzov, Tchiflik, near Roustchouk, northern Bulgaria. The sample of the first of the unnamed varieties, which for identification purposes will be called red winter A, was grown near Plevan, in the central part of northern Bulgaria. It is said to represent about 99 per cent of all the soft red winter wheat of the *vulgare* species grown in northern Bulgaria. The second unnamed variety of soft red winter wheat was called red winter B. This variety was grown in the Province of Stara Zagora, and is said to be representative of most of the soft red winter wheat grown in southeastern Bulgaria.

The variety Beloclassa Tchervenca No. 84 is said to be representative of the hard red winter wheats grown in northern Bulgaria. The particular variety tested was grown at Obrastzov, Tchiflik, near Roustchouk, in northern Bulgaria.

The variety of spring wheat presented was also without a name. However, it is said to be grown on only a small scale on the plains near Pirdop, east of Sofia. It is the only spring wheat grown in Bulgaria.

Only a relatively small acreage is devoted to the production of white wheat. The variety Pirdopska Belia is the most important. The variety tested was grown at the agricultural experiment station at Sadvvo, Bulgaria.

Data relating to the grading, milling, and baking qualities of these varieties are found in Tables 40, 41, and 42. With the exception of wheat of the durum variety Red-awned Zagaria, all these varieties were of good milling quality, particularly the hard red winter wheat variety Beloclassa Tchervenca No. 84.

TABLE 40.—*Wheats grown in Bulgaria: Description and characteristics of the variety samples*

Laboratory No.	Region where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14196	Pirdop, near Sofia	White Spring	Hard red spring	2 Dark Northern Spring	1.2	61.6	60.3	3.1	1.0	1.5
14193	Southern Bulgaria	Red-awned Zagaria	Durum	2 Amber Durum	.0	92.3	59.0	5.0	.4	.0
14194	Southwestern Bulgaria	Zagaria	do	3 Amber Durum	2.5	89.6	56.7	3.8	.6	1.3
14198	Northern Bulgaria	Beloclassa Tchervenca No. 84	Hard red winter	2 Hard Winter	.0	30.2	59.5	3.8	2.7	.0
14197	North central Bulgaria	Red winter A	Soft red winter	2 Red Winter	.0		58.4	3.6	2.2	1.0
14195	Southwestern Bulgaria	Red winter B	do	3 Red Winter	3.1		56.6	3.3	1.0	1.4
14199	Northern Bulgaria	Tchervenoclassa Tchervenca No. 16	do	do	.0		57.2	3.9	1.4	.0
14200	Southern Bulgaria	Pirdopska Belia	White	2 Hard White	.0	78.0	59.3	4.2	1.7	.0

TABLE 41.—*Wheats grown in Bulgaria: Milling properties of the variety samples described in Table 40, and certain chemical constituents of the wheats and of flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour	
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*				
14196	62.5	3.0	9.0	69.8	68.6	272	Soft	Soft	White	1.16
14193	60.0	4.6	8.8	71.5	68.2	273	Very hard	Granular	Creamy	1.75
14194	58.9	7.8	8.7	69.0	65.3	284	do	do	do	1.94
14198	61.7	2.4	9.3	72.7	71.0	263	Semihard	Soft	White	1.10
14197	60.8	2.6	9.2	69.0	67.2	278	do	do	do	1.58
14195	59.2	6.6	9.0	69.2	66.7	279	Soft	do	do	1.40
14199	58.4	4.5	9.1	71.1	67.9	275	do	Very soft	do	1.85
14200	60.6	5.0	8.7	71.3	67.7	274	do	do	do	1.42

Laboratory No.	Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
			pH	Lactic acid							
	Per cent	*Per cent*		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	
14196	0.66	2.06	6.56	0.390	11.11	10.04	3.08	5.31	8.39	36.71	1.90
14193	.77	1.59	6.62	.285	12.46	12.03	4.26	6.12	10.38	41.04	2.65
14194	.89	2.18	6.70	.195	11.65	11.11	3.55	6.24	9.79	36.26	2.62
14198	.41	1.67	6.51	.342	16.49	9.16	3.43	4.38	7.81	43.92	2.02
14197	.49	1.86	6.57	.337	10.18	9.15	2.92	4.87	7.79	37.48	2.25
14195	.71	1.91	6.60	.252	9.00	7.87	2.75	3.72	6.47	42.50	2.46
14199	.36	1.65	6.54	.252	9.44	8.09	2.84	3.98	6.82	41.64	2.44
14200	.43	1.77	6.49	.380	12.15	10.39	3.48	5.51	8.99	38.71	2.00

TABLE 42.—*Wheats grown in Bulgaria: Baking properties of the variety samples described in Tables 40 and 41*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	Minutes	P. ct.	C. c.	Gm.	Score	Score					Lbs.
14198	112	61	53.4	1,870	487	78	84	Fair	Creamy, gray.	Light brown	Fair	281
14193	140	50	61.8	1,860	514	80	92	Excellent	Very creamy	Brown	Poor	286
14194	140	65	62.6	1,880	509	82	87	do	do	Foxy brown	Fair	293
14198	112	65	52.2	1,660	480	86	90	Good	Creamy	Light brown	do	277
14197	113	71	52.2	1,680	484	86	90	do	do	do	do	279
14195	126	65	49.7	1,780	478	75	80	Fair, crumbly.	Creamy, gray.	Pale	do	275
14199	113	82	50.1	2,060	479	81	83	Fair	Very creamy	do	do	270
14200	120	76	49.4	2,340	477	88	92	Good	Creamy	Brown	Good	275

From a baking standpoint the flour milled from all classes of Bulgarian wheat was of greater baking strength than that milled from many of the wheats grown in other parts of continental Europe. Considering the low protein content of the flours milled from some of the Bulgarian wheats, the resulting bread was remarkably good. However, except the flours milled from the durum wheats and from the variety of spring wheat, all of the Bulgarian wheat flours were lacking in baking quality through their inability to produce a large quantity of bread from a given unit of flour. It would appear, therefore, that Bulgarian wheats are good filler wheats but could not be used as the major portion in a wheat blend where wheat of strong character is necessary to bolster up the quality of weaker wheats.

CZECHOSLOVAKIA

The production of wheat in Czechoslovakia is above the pre-war level. In 1928 production amounted to approximately 51,499,000 bushels. The heaviest wheat-producing acreages are in the northwestern and south-central sections of the country. Large quantities of wheat are imported annually. In 1927–28 imports exceeded 21,000,000 bushels. In Czechoslovakia the majority of the wheat grown is winter wheat.

The outstanding conditions that influence wheat production and quality are extreme winter temperatures and summer storms. Low temperatures in the fall and spring are frequently detrimental. Owing to slow development, the wheat crop is often caught in the tillering stage by hot summer winds.

Important among the varieties of wheat grown in Czechoslovakia are Dioseg bearded winter wheat No. 2, Dregr Bohemian red winter wheat No. 12, Dregr winter B ½₂, and Sebek winter-spring wheat No. 11. Dioseg bearded winter wheat is grown principally in southwestern Slovakia. The Dregr wheats are grown mainly in eastern Bohemia, whereas Sebek wheats are grown mainly throughout central Bohemia.

Through the courtesy of the Czechoslovakian minister to the United States, samples of the four types of wheats mentioned were sent from the agricultural experiment station at Prague. Unfortunately, those of Dregr Bohemian red winter No. 12, and Dregr winter B ½₂, were lost in transit, so that the milling and baking quality of only Dioseg bearded winter wheat No. 2 and Sebek winter-spring No. 11 could be tested. The milling and baking qualities of the latter two varieties are given in Tables 43, 44, and 45.

TABLE 43.—*Wheat grown in Czechoslovakia: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13983	Agricultural experiment station, Prague	Sebek No. 11	Hard red spring	2 Dark Northern Spring	0	76.1	61.8	3.5	2.3	0
13984	do	Dioseg No. 2	Hard red winter	1 Hard Winter	0	76.4	62.4	3.5	.4	0

TABLE 44.—*Wheats grown in Czechoslovakia: Milling properties of the variety samples described in Table 43, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13983	63.7	1.1	10.5	77.2	76.3	248	Hard	Granular	Slightly creamy	1.28	0.56	1.73	6.56	0.304	12.18	11.66	3.83	6.03	9.86	38.84	2.05
13984	63.2	.9	10.9	73.7	73.1	260	Semihard	Soft	do	1.95	.52	1.66	6.67	.204	10.08	9.29	3.35	4.49	7.84	42.86	2.39

TABLE 45.—*Wheats grown in Czechoslovakia: Baking properties of the variety samples described in Tables 43 and 44*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13983	127	48	59.3	1,860	512	84	52	Poor, crumbly	Creamy, gray	Brown	Poor	295
13984	97	49	54.8	1,620	500	79	42	Poor	Creamy	Light brown	do	288

Both varieties tested showed exceptional milling properties. From a baking standpoint, however, both varieties lacked strength. The bread made from the flour milled from Sebek No. 11, although having a fair volume of loaf, was very crumbly and coarse in texture. The baking quality of the flour milled from the variety Dioseg No. 2 was even less desirable than that milled from the variety Sebek No. 11. The volume of loaf was noticeably low. The bread was poor in color and exceptionally coarse in texture and grain.

The wheats of Czechoslovakia, as illustrated by these two varieties, although of very good milling properties are noticeably lacking in baking strength.

DENMARK

Wheat production in Denmark has increased about 50 per cent since before the World War. In 1928 wheat production amounted to 12,214,000 bushels. Imports of wheat run from 6,000,000 to 11,000,000 bushels annually. Up to 1928 there had been no increase in imports since the war.

The wheat-producing sections are Seeland, comprising the Amts of Copenhagen, Holbaek, Soro, and Praesto; and Fyn, comprising the Amts of Odense, and Svendborg. In Jutland, Aarhus, Vejle, Skanderborg, Randers, and Haderslev, are the wheat-producing areas. By far the greatest wheat-producing area in Denmark is the Amt of Maribo, located on the islands of Lolland and Falster.

Conditions for wheat growing are much more favorable in Denmark than in Norway or Sweden. In spite of this, most of the native wheat is used for livestock, and little is used for bread making.

According to L. P. M. Larsen, of the Danish Agricultural Society, at Copenhagen, Tystofte Small Wheat 11 is the most commonly grown variety. Tystofte 11 is a red winter wheat selected from Squarehead Master and has been adapted and acclimated to Danish conditions.

Pansar, a hybrid of Squarehead Master, is also grown. Its acreage is reported to be increasing because of its high productivity and quality. Trifolium, a selection from the Dutch white wheat Wilhelmina, is extensively grown because of its winter resistance. On the other hand, the cultivation of the variety Wilhelmina is decreasing on account of winterkilling.

The red winter variety Aben Dania is now being introduced.

Milling and baking tests of the varieties Tystofte 11, Trifolium, and Abed Dania were made possible through the courtesy of L. P. M. Larsen, of the Danish Agricultural Society. The results of these tests are given in Tables 46, 47, and 48.

The milling quality of the two white wheat varieties was slightly below the average for wheat of this class, whereas that of the soft red winter wheat variety was high. The protein content of the wheats, as well as of the resulting flours, was low. With this factor as a handicap, the resulting bread was small in volume, coarse in texture, and of poor color. Blending with strong overseas wheats would materially strengthen the flours milled from Danish wheats.

TABLE 46.—*Wheats grown in Denmark: Description and characteristics of the variety samples*

Laboratory No.	Region where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Gm.*	*Per cent*	*Per cent*
13646	(1)	Tystofte Small Wheat II	Soft red winter	2 Red Winter	0		59.1	3.5	0.3	0
13648	(1)	Abed Dania	do	3 Red Winter	0		57.1	3.4	.8	0
13647	(1)	Trifolium	White	2 Soft White	0	15.2	58.8	3.7	.5	0

[1] Received from Danish Agricultural Society, Copenhagen. No information as to area in which grown.

TABLE 47.—*Wheats grown in Denmark: Milling properties of the variety samples described in Table 46, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13646	59.3	0.9	13.1	71.4	70.8	276	Soft	Soft	White		0.43	1.66	6.56	0.285	8.37	7.47	2.43	2.67	6.10	43.77	2.06
13648	58.1	1.0	13.1	70.1	69.4	281	do	do	do		.47	1.55	6.52	.311	9.77	8.85	3.27	4.27	7.54	43.37	2.24
13647	59.0	.8	14.1	71.5	71.1	278	do	do	do		.40	1.83	6.50	.311	8.51	7.14	2.67	3.27	5.94	44.95	2.37

TABLE 48.—*Wheats grown in Denmark: Baking properties of the variety samples described in Tables 46 and 47*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13646	106	51	51.9	1,590	492	25	58	Poor, solid	Creamy	Pale	Poor	283
13648	104	50	53.0	1,550	492	32	32	do	Very creamy	Brown	do	283
13647	105	52	52.0	1,730	490	35	41	do	Creamy	Pale	Fair	282

ENGLAND

Wheat growing in England is greatly affected by the climate. In all Great Britain excessive rains and insufficient sunshine contribute significantly to the quality of the grain. Excessive rains often delay sowing in the autumn, and in the winter they cause water logging of the soil. In the spring and especially in the summer, excess rain may cause lodging of the grain with a resulting loss in quality. In the northern counties alternate freezing and thawing at the close of the winter is harmful.

Common wheats of both spring and winter habits are grown; red and white wheats of winter habit and red spring varieties predominate. Very little white wheat of spring habit is grown, nor are the club or durum species of commercial importance in England.

Resistance to excess rainfall and to lodging, and the faculty of ripening during the rainy and cloudy period, constitute the essential characteristics of a good English wheat.

Through the courtesy of the National Institute of Agricultural Botany at Cambridge, the Department of Agriculture of the University of Leeds, and the Department of Agricultural Botany of the University of Reading, samples of most of the outstanding commercial varieties of wheat now grown in England were obtained. Three of the varieties studied were spring wheats, 10 were soft red winter wheats, and 3 were white wheats of winter habit.

In submitting the samples the following general information was supplied:

The red winter wheat Squareheads Master is the most widely grown and the most generally suitable for the different types of soil in England. Yeoman, also a red winter wheat, is unique among English wheats as the only variety that produces a flour suitable for making shapely and well-piled loaves of pleasant flavor without the addition of strong wheats from abroad. It is particularly suitable for land in good fertility and is most widely grown in the south and east portions of England. The red winter variety Little Joss is more suitable to the lighter land and is grown throughout England and Wales. Swedish Iron, also a red winter variety, is a heavy-yielding wheat suitable for heavy soils and is grown particularly in the northern part of England. Other red winter varieties grown more or less are Standard Red, Chevalier, Crown, Biffens Yeoman, and Percivals Fox.

White winter wheats are not so popular with the English farmer as are the red wheats, although the white winter wheat Gartons Victor is widely grown. The white winter variety Wilhemina is also grown on heavy soils.

Of the red spring wheats, Red Marvel is the most important, April Bearded is second in importance, and Red Nursery is least important. The production of spring wheats is fairly well spread throughout England south of a line drawn between the Mersey and the Humber.

The grading, milling, and baking data resulting from the analyses of these wheats are found in Tables 49, 50, and 51.

TABLE 49.—*Wheats grown in England: Description and characteristics of the variety samples*

Laboratory No.	Where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14178	Essex	April Bearded	Hard red spring	1 Northern Spring	0.0	41.9	62.8	3.3	1.0	0.0
14177	do	Red Marvel	do	1 Red Spring	.0	.1	61.0	5.2	.3	.0
14175	do	Red Nursery	do	do	.0	1.2	60.5	4.0	.4	.0
13894	Reading	Squareheads Master	Soft red winter	1 Red Winter	.0		60.8	4.4	1.3	.0
13937	do	Percivals Fox	do	do	.0		61.9	3.5	.1	.0
13895	do	Biffens Yeoman	do	2 Red Winter	.0		59.7	3.9	3.6	.3
14182	Leeds	Iron III	do	3 Red Winter	.0		58.9	4.3	4.7	.0
14176	Cambridge	Little Joss	do	do	.0		61.7	4.7	6.7	.0
14179	do	Squareheads Master	do	do	.0		62.0	4.7	6.6	.0
14183	Leeds	Standard Red	do	do	.0		61.3	4.6	4.6	.1
14181	Cambridge	Swedish Iron III	do	do	.2		58.6	4.3	5.6	.1
14184	Leeds	Crown	do	4 Red Winter	.0		59.0	4.5	9.8	.0
14180	Cambridge	Yeoman II	do	5 Red Winter	.1		60.9	4.2	10.4	.0
13936	Reading	Gartons Victor	White	1 Soft White	.0	19.2	60.8	4.2	1.4	.0
13935	do	Percivals Starling	do	do	.0	30.4	60.4	4.2	2.0	.0
14185	Cambridge	Wilhelmina	do	4 Soft White	.2	34.9	60.6	4.5	9.2	.0

TABLE 50.—*Wheats grown in England: Milling properties of the variety samples described in Table 49, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
14178	64.8	0.9	8.6	72.1	71.5	259	Semihard	Soft	Creamy	1.48	0.56	1.82	6.47	0.418	11.28	10.53	3.75	4.99	8.74	42.91	1.96
14177	61.3	2.0	8.7	73.0	71.6	259	do	Granular	Slightly creamy	1.31	.48	1.67	6.63	.318	9.77	8.87	2.67	4.61	7.28	36.68	2.18
14175	61.5	1.7	8.8	73.6	72.4	257	Soft	Very soft	do	1.29	.45	1.66	6.58	.385	8.18	7.59	2.50	3.77	6.27	39.87	2.16
13894	61.5	1.0	11.9	70.4	69.7	276	do	Soft	White	1.50	.44	1.55	6.52	.416	10.27	9.40	3.14	4.70	7.84	40.05	2.29
13937	63.3	1.2	11.1	73.3	72.4	263	do	Very soft	do	1.31	.51	1.75	6.49	.439	10.52	9.21	3.55	4.02	7.57	46.70	1.91
13895	60.7	1.0	12.8	70.5	69.8	279	do	Soft	do	1.18	.55	1.67	6.33	.238	9.90	8.98	3.11	4.24	7.35	42.32	2.07
14182	59.9	2.5	9.2	72.0	70.2	266	do	Very soft	do	1.03	.60	1.69	6.54	.394	7.64	6.68	2.40	2.84	5.24	45.80	2.38
14176	62.7	2.2	9.0	72.4	70.7	264	do	Soft	do	.96	.45	1.68	6.47	.399	10.09	9.14	2.91	4.59	7.50	38.80	2.29
14179	62.7	2.6	8.7	74.1	72.1	258	do	Very soft	Slightly creamy	1.21	.51	1.66	6.46	.399	10.28	9.34	3.50	4.19	7.69	45.51	2.20
14183	62.1	2.5	9.3	69.3	67.6	292	Very soft	do	White	1.14	.46	1.69	6.43	.418	9.54	8.24	2.69	4.24	6.93	38.82	2.37
14181	59.0	2.8	8.9	70.9	69.0	270	Soft	do	do	.88	.57	1.67	6.55	.394	7.97	7.14	2.59	3.21	5.80	44.66	2.68
14184	59.6	3.5	9.3	69.7	67.3	278	Very soft	do	do	1.19	.55	1.71	6.55	.408	8.32	7.23	2.50	3.48	5.98	41.81	2.57
14180	62.1	2.5	8.9	74.2	72.3	258	Soft	Soft	do	.80	.46	1.73	6.46	.480	9.94	8.51	2.84	4.36	7.20	39.44	2.47
13936	61.3	2.0	10.9	73.1	71.7	265	do	do	do	1.42	.45	1.33	6.56	.240	9.27	8.16	2.80	3.93	6.73	41.60	2.43
13935	61.7	1.7	11.0	72.4	71.5	266	do	do	do	1.37	.48	1.65	6.39	.381	9.08	7.99	2.86	3.72	6.62	43.20	2.24
14185	61.9	3.5	9.0	72.1	69.5	268	do	do	do	1.20	.42	1.64	6.50	.423	8.50	7.91	2.49	4.03	6.52	38.19	2.43

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TABLE 51.—*Wheats grown in England: Baking properties of the variety samples described in Tables 49 and 50*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14178	98	49	53.0	1,600	493	72	57	Poor, crumbly	Very creamy	Light brown	Poor	284
14177	98	50	51.8	1,580	494	78	62	Fair, crumbly	Creamy	Pale	do	285
14175	99	49	51.8	1,620	495	78	62	do	do	do	do	285
13894	101	48	53.9	1,520	503	84	22	Poor, crumbly	Very creamy	Light brown	No break	290
13937	96	57	52.4	1,550	498	82	14	Very poor, crumbly	Creamy, gray	do	Poor	287
13895	93	56	50.2	1,680	506	88	45	Poor, crumbly	Creamy	do	do	291
14182	107	53	48.8	1,460	475	76	55	Poor	Creamy, gray	Pale	Very poor	274
14176	93	49	52.8	1,590	495	77	58	Fair, crumbly	Creamy	do	Poor	285
14179	98	47	53.4	1,600	498	78	54	Poor, crumbly	Very creamy	Light brown	do	287
14183	104	52	53.0	1,660	493	74	71	Fair, crumbly	Creamy	Pale	do	284
14181	112	51	51.7	1,600	482	85	68	Fair	Creamy, gray	do	do	278
14184	97	52	52.0	1,600	488	78	64	Poor	do	Light brown	Fair	281
14180	94	51	56.1	1,810	504	90	88	Good	Light creamy	do	Poor	291
13936	93	52	51.9	1,500	494	85	14	Very poor, crumbly	Creamy	Pale	do	285
13935	94	52	52.2	1,530	495	85	15	do	do	do	do	285
14185	96	62	52.2	1,640	486	83	82	Fair	do	Light brown	Fair	280

With the exception of the varieties Biffens Yeoman and Standard Red, all the English wheat varieties produced a high percentage of flour which compared very favorably with the flour milled from wheats of similar classification grown in any other country in the world.

The majority of the English wheats did not produce flours that were well suited to bread making. The loaves made in the test were small in volume and very coarse in texture. The color of the crumb and crust was inferior. The flours lacked that characteristic technically described as strength. This is emphasized by the low protein content of the flours, their low water absorption, and their short fermentation time. The flour milled from the variety Yeoman II was the only flour regardless of class that was of acceptable baking quality.

An important factor that has been touched upon before, is the moisture content of English wheats. In dryness English-grown wheat can not often compare with imported wheat. English wheat, as marketed, often contains more than 20 per cent of water, whereas Indian wheat may have as little as 10 per cent, and the average for imported wheat of all descriptions is about 14 per cent. Thus a miller must pay less for English wheat with its high water content than for the drier imported wheat.

The faults of English wheat varieties outweigh their good qualities to such an extent that millers situated at the ports make use of the English crop only when prices are very low. Under the present conditions, with foreign wheat coming freely into the country (222,000,000 bushels into the United Kingdom in 1927–28), port millers are independent of the home crop and can almost ignore it. The inland miller, however, has to utilize as far as possible the crop grown in the neighborhood of his mills. When this consists of the ordinary English varieties, large quantities of "strong" foreign wheat must be brought in by rail to mix with it, otherwise the flour will not produce loaves of sufficient volume to be saleable. Ordinarily the proportion of English wheat used in the blend amounts to only about 20 per cent on an average.

ESTONIA

Production of wheat in Estonia has increased tremendously since pre-war times. The average production from 1909–1913 was 364,000 bushels a year, as compared with 1,037,000 bushels in 1928.

Drought is one of the most striking climatic factors affecting the production of wheat in Estonia. Drought is generally accompanied by late frosts which are harmful, in that they injure the wheat seedlings. Other harmful climatic factors are excessive rains in the spring and summer, and sometimes excessive heat in July.

Both fall and spring sowings are made.

The variety Sangaste, a white winter wheat, comprises about 60 per cent of all the white winter wheat of the vulgare species grown in Estonia. Bearded spring wheat of no variety name comprises about 70 to 80 per cent of all the red spring wheat sown. About 5 per cent of the variety Rubin is also sown as spring wheat. The variety Marquis is now being tested experimentally.

Samples of four varieties were obtained from R. Allman, of the department of agriculture, at Tallin, Estonia. Milled and baked in the usual manner, the samples yielded the data given in Tables 52, 53, and 54.

TABLE 52.—*Wheats grown in Estonia: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14021	Agricultural experiment station, Jogera.	Rubin	Hard red spring	Sample Dark Northern Spring	0	95.1	56.6	3.2	5.7	0
14022	do	Marquis	do	1 Northern Spring	0	32.2	62.2	3.4	1.5	0
14020	do	Bearded spring	do	3 Northern Spring	0	38.2	62.7	3.5	5.0	0
14019	do	Sangaste	White	1 Hard White	0	80.2	61.0	3.9	.6	0

TABLE 53.—*Wheats grown in Estonia: Milling properties of the variety samples described in Table 52, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*					*Per cent*	*Per cent*		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	
14021	58.1	2.6	9.7	68.2	66.4	284	Hard	Granular	White	1.24	0.59	1.85	6.60	0.349	12.45	11.97	3.80	6.54	10.34	36.75	1.97
14022	62.9	1.1	10.2	74.0	73.2	258	do	do	do	1.42	.69	1.78	6.56	.332	10.99	10.48	3.78	5.02	8.80	42.95	1.98
14020	63.5	1.5	10.1	72.0	70.9	266	do	do	do	1.49	.53	1.74	6.56	.337	9.68	8.82	2.98	4.41	7.39	40.23	2.62
14019	61.7	1.8	9.6	73.3	72.0	261	Semihard	do	do	1.17	.57	1.70	6.44	.277	12.50	12.04	3.67	6.82	10.49	34.99	1.88

TABLE 54.—*Wheats grown in Estonia: Baking properties of the variety samples described in Tables 52 and 53*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14021	130	62	60.3	1,920	513	84	79	Fair, crumbly	Creamy, gray	Brown	Poor	296
14022	133	56	59.4	1,850	512	84	78	do	do	do	do	295
14020	128	57	59.1	1,610	511	79	58	Poor, crumbly	Very creamy	do	do	295
14019	111	45	56.8	1,630	504	83	16	Very poor, crumbly	Creamy, gray	do	do	291

The white winter variety Sangaste was of excellent milling quality, it was superior in this respect to any of the spring-wheat varieties. Among the spring wheats, the milling quality of the variety Rubin was poor, whereas that of the variety Marquis, and Bearded spring were much better than the average for this class of wheat.

Baking strength of the variety Sangaste was very poor in every respect. Among the spring wheats, the order of merit as far as baking strength is concerned, was Rubin, first; Marquis, second; and Bearded spring, third.

The wheats of Estonia are similar to those of Latvia, Lithuania, and Poland, in that they need extensive blending with stronger wheats to improve their baking quality.

GERMANY

The production of wheat in Germany is still below the pre-war average, but the trend is upward. In 1926 more than 95,000,000 bushels of wheat were raised, in 1927 the production was 120,522,000 bushels, and in 1928 the estimated production was 142,000,000 bushels. Production of wheat does not keep pace with home demands, and it is necessary to import large quantities from overseas. Nearly 99,000,000 bushels were imported in 1927–28. Exports of wheat from Germany are normally small, although in certain crop years very large quantities are exported. The production of wheat is confined largely to the common wheats, although some spelt is grown.

In Germany, winter adversity, of more or less intensity, and excessive rains during the summer are the outstanding factors controlling the production of wheat.

According to acreages reported in 1926 and 1927, the important wheat-producing States, in the order of importance, are Saxony, Bavaria, Lower Silesia, Hannover, Brandenburg, Brunswick, Württemberg, and Pommerania.

Wheat in Germany is largely fall sown. Through the selection of winter-resistant types, the area of fall-sown wheat now extends to the extreme north of the Prussian plain. If the cultivation of fall-sown wheats becomes impossible, they are replaced by wheats of spring habit.

The varieties of wheat grown in Germany are of four types—local wheats, almost always modified by selection to withstand adverse climatic conditions; such types as Squarehead (Dickkopf selected); hybrids, obtained by crossing Dickkopf with local varieties; and imported types of Swedish origin, such as the variety Pansar.

The distribution of any given variety is regulated almost entirely by its resistance to adverse climatic conditions. Three important fall-sown varieties are General von Stocken, Criewener, and Dickkopf, and their resistance to adverse climatic conditions is in the order named. Among the spring wheats Strubes roter Schlanstedter is the most extensively grown. This variety represents about 50 per cent of the spring wheat. Other spring varieties are Bethges and Janetzkis. These two varieties are grown in the Baltic States.

Samples of varieties of wheat reported to be of commercial importance in Germany were obtained from two sources—the Württemburg Landessaatzuchtanstalt Hohenheim of Hohenheim-Stuttgart and Der von Arnim'sche Saatzuchtwirtschaft of Criewen. From the

first source samples of six varieties were received: Gabriel Muhlbachweizen 1, Jagers Hohenheimer Albweizen, Strubes roter Schlanstedter Sommerweizen, Hohenheimer Sommerweizen 25 f, Hohenheimer Sommerweizen alte Zuchtung, and Steiners roter Tiroler Dinkel (*Triticum spelta*). A sample of only one variety was received from the latter source, namely, Criewener Winterweizen No. 104. In Württemberg, spelt is as important as fall-sown wheat and is considered by the Swabin farmers, millers, and bakers as of better quality than the fall-sown wheat, but no tests were made on this variety.

The results of the tests made on the wheat varieties named are given in Tables 55, 56, and 57. According to the manner of classifying wheat in the United States, the variety Hohenheimer Sommerweizen 25 f, and Hohenheimer Sommerweizen alte Zuchtung, were considered as hard red spring wheats. All the other German varieties were classified as soft red winter wheats.

The protein content of all the varieties, with the exception of that of the variety Gabriel Muhlbachweizen 1, was excellent for the classes of wheat in question.

The milling quality of the German wheat varieties went hand in hand with their test weight per bushel values. Three of the varieties, one spring wheat and two soft winter wheats, demonstrated excellent milling quality. The variety Hohenheimer Sommerweizen alte Zuchtung, largely on account of its bushel weight, was of only average milling quality. The varieties Gabriel Muhlbachweizen 1 and Jagers Hohenheimer Albweizen were soft red winter varieties of inferior milling quality.

The baking strength of the flour milled from all of the German varieties, with the exception of that of the variety Hohenheimer Sommerweizen alte Zuchtung, was not great. The volume of the loaves of bread in each instance was somewhat small and the texture and grain of the crumb were poor and in some instances crumbly. The color of the crumb was also undesirable.

As far as baking performance is concerned, German wheats resemble in a marked degree English-grown wheat.

GERMAN EXPORT WHEATS

German export wheats are very largely soft red winter wheats. Characteristic of the German export wheats of the 1926 crop are those described in Tables 58, 59, and 60. Wheat of somewhat low test weight per bushel was the rule. On the other hand, the wheats were clean and did not contain an excessive quantity of damaged kernels. From a milling standpoint they produced a large quantity of flour of medium protein content. The ash content of the flour was of the same order as is obtained from straight-grade flour milled from North American grown soft red winter wheats. The quality of the protein in the flour, however, was not good. This fact is emphasized by the data relative to the baking tests made on these flours. The water absorption of the flours was distinctly low, the fermentation time of the dough was very short, and the resulting loaf was small in size, poor in color, and poor in texture of crumb.

TABLE 55.—*Wheats grown in Germany: Description and characteristics of the variety samples*

Laboratory No.	Region where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
15171	Wurttemberg	Hohenheimer Sommerweizen 25 f.	Hard red spring	2 Dark Northern Spring	0.2	91.6	59.1	4.0	3.5	0
15172	do	Hohenheimer Sommerweizen alte Zuchtung.	do	4 Dark Northern Spring	.0	97.6	56.1	3.0	7.1	0
14583	Criewen	Criewener Winterweizen No. 104.	Soft red winter	2 Red Winter	.0		58.6	4.6	.1	0
15173	Saxony	Strubes roter Schlanstedter Sommerweizen.	do	3 Red Winter	.0		60.4	4.2	4.4	0
15174	Swabian Mountains	Jagers Hohenheimer Albweizen	do	4 Red Winter	.0		54.1	3.8	4.5	0
15175	Wurttemberg Black Forest.	Gabriel Muhlbachweizen I	do	do	.0		55.7	4.3	.6	0

TABLE 56.—*Wheats grown in Germany: Milling properties of the variety samples described in Table 55, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Harlhor angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
15171	61.2	2.0	11.4	73.3	71.8	267	Hard	Granular	White	1.36	0.52	2.07	6.38	0.536	13.13	12.06	3.89	6.50	10.39	37.44	1.98
15172	58.5	1.9	11.5	71.1	69.7	275	do	do	do	1.07	.58	1.97	6.38	.518	14.45	13.03	4.88	6.44	11.32	43.11	2.10
14583	58.2	2.7	11.2	74.0	71.9	265	Very soft	Very soft	Creamy	2.31	.50	1.78	6.55	.439	9.67	8.25	2.64	4.38	7.02	37.61	2.32
15173	61.5	2.0	11.0	72.9	71.4	267	Soft	do	White	1.59	.51	1.94	6.51	.404	10.62	9.55	2.96	4.81	7.77	38.09	2.25
15174	56.6	4.3	10.5	70.3	67.3	281	do	Soft	Slightly creamy	1.93	.46	1.81	6.41	.457	10.62	9.78	2.96	4.99	7.95	37.23	1.79
15175	57.1	2.1	10.9	69.0	67.6	280	do	do	do	1.80	.56	1.75	6.49	.350	7.79	6.70	2.41	2.03	5.24	45.99	1.83

TABLE 57.—*Wheats grown in Germany: Baking properties of the variety samples described in Tables 55 and 56*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
15171	139	45	62.4	1,780	504	82	84	Very poor, crumbly	Creamy	Brown	Poor	291
15172	142	48	65.8	1,960	519	89	92	Good	Light creamy	do	Excellent	299
14583	130	48	52.2	1,600	491	78	74	Very poor, crumbly	Very creamy	Pale	Very poor	283
15173	126	56	56.6	1,790	493	83	80	do	do	Brown	Poor	284
15174	122	59	54.3	1,820	491	84	83	Poor, crumbly	do	do	do	283
15175	154	78	55.3	1,720	485	82	80	Very poor, crumbly	do	Pale	Very poor	280

TABLE 58.—*German export wheats: Port of loading and unloading and description and characteristics of samples taken at the port of loading*

Laboratory No.	Port of loading	Port of unloading	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13736	Eckanforde	Bremen, Germany	Soft red winter	4 Red Winter	0.3		56.9		1.2	3.4
14016	Hamburg	Dunkirk, France	do	2 Red Winter	.4		58.0		1.4	.1
14015	do	do	do	3 Red Winter	.4		57.8		4.3	.8
14004	do	do	do	4 Red Winter	.4		55.3		3.0	.3
13735	Heligenhafen	Bremen, Germany	do	2 Red Winter	.3		59.0		2.0	.3
14299	Stettin	London, England	do	3 Red Winter	.2		56.4		3.0	.2
	Average				.3		57.2		2.5	.8

TABLE 59.—*German export wheats: Milling properties of the samples described in Table 58 and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*					*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	
13736	57.9	2.0	11.0	69.5	68.1	279	Soft	Soft	White	1.19	0.50	6.44	0.402	10.10	9.50	1.94
14016	59.4	2.0	10.2	72.4	71.2	265	do	Very soft	do	1.29	.50	6.64	.376	10.23	9.33	1.92
14015	58.7	2.5	10.0	71.4	69.9	270	do	do	do	1.37	.49	6.62	.332	10.21	9.20	1.95
14004	57.0	3.5	9.4	70.1	67.9	273	do	Soft	Slightly creamy	1.65	.51	6.38	.420	10.70	9.50	1.88
13735	60.2	1.2	10.9	69.7	69.1	275	do	do	White	1.88	.46	6.43	.388	9.71	8.90	1.72
14299	57.0	2.1	12.2	71.1	69.7	277	do	do	do	1.81	.60	6.47	.528	10.10	9.41	2.06
Average	58.4	2.2	10.6	70.7	69.3	273	do	do	do	1.53	.51	6.50	.408	10.18	9.32	1.91

TABLE 60.—*German export wheats: Baking properties of the samples described in Tables 58 and 59*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13736	118	52	54.4	1,790	501	78	76	Poor	Very creamy	Light brown	Poor	289
14016	101	50	52.5	1,660	496	76	39	Poor, crumbly	do	do	do	286
14015	100	50	51.2	1,680	489	77	44	do	do	do	do	282
14001	103	48	51.7	1,650	492	72	30	do	Creamy	Brown	do	284
13735	121	49	53.3	1,670	497	80	72	Poor	Very creamy	Light brown	do	287
14299	102	56	50.1	1,810	488	79	61	do	Very creamy, gray	do	do	281
Average	108	51	52.2	1,710	494	77	54	do	Very creamy	do	do	285

GREECE

Production of wheat in Greece has decreased since pre-war days, whereas imports have increased. Wheat growing in Greece is markedly affected by the action of many weather factors, such as the quantity and distribution of rainfall, high temperatures, and the prevalence of warm dry winds known as siroccos or livas. More than half of the wheat grown in Greece is produced on the plains of eastern Greece, where the climate is the most uniform in the country. Wheat is fall sown. Spring wheat is not cultivated extensively.

Durum varieties and some soft wheat (soft red winter and white wheat) constitute the wheats of commerce. A small quantity of poulard wheat is also grown. Samples from the 1926 harvest of the most commonly grown commercial varieties were obtained from M. [illegible] Papadakis, director of the Station d'Amelioration des Plantes, at [illegible]issa, Greece. The names of the varieties represented are given in Table 61.

TABLE 61.—*Wheats grown in Greece: Description and characteristics of the variety samples*

Laboratory No.	Region where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Durumoid kernels	Foreign material other than dockage
					P. ct.	*P. ct.*	*Lbs.*	*Gm.*	*P. ct.*	*P. ct.*
14495	Pharsala	Camboura	Durum	2 Amber Durum	0.2	95.4	58.1	5.4	0.3	1.3
14494	do	Deves	do	do	.6	81.2	59.9	4.0	.0	.5
14493	Larissa	do	do	3 Durum	.1	46.2	59.2	4.2	.6	.1
14496	Kajalar	Katranitsa	White	3 Mixed (white, 80 per cent; soft red winter, 16.2 per cent).	.8	------	57.1	3.7	4.0	.1

Information accompanying these samples stated that the crop year represented was normal. The variety known as Deves, sample No. 14493, was described as a hard wheat grown on the plains of Larissa, upon soils of ordinary fertility. This variety is cultivated almost exclusively in the plains of Thessaly, except on the very moist soils, and is combined with a little soft wheat for growing in central Macedonia. As far as quality is concerned, it represents the type of average production in Oriental Thessaly.

A second variety of Deves, sample No. 14494, is described as being grown on fertile soils in the locality of Pharsala. It represents the type of hard wheat grown in Thessaly upon fertile soil, especially in Occidental Thessaly.

The variety Camboura is described as a hard wheat. It is said to be grown in the locality of Pharsala, and on the fertile soils around the Lake of Capais.

The variety Katranitsa is described as a soft wheat. Its area of distribution is in Occidental Macedonia, in the locality of Kajalar.

Classified according to the United States standards for wheat, the varieties Deves and Camboura are durum wheats, whereas the wheat represented by the variety Katranitsa is a mixture of soft red winter and soft white wheat. Results of the grading, milling, and baking tests made on these wheats are given in Tables 61, 62, and 63.

TABLE 62.—*Wheats grown in Greece: Milling properties of the variety samples described in Table 61, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14495	59.4	6.4	10.8	72.5	67.9	280	Very hard	Granular	Creamy	1.45	0.97	1.87	6.52	0.456	15.42	13.44	4.82	6.69	11.51	41.88	3.28
14494	60.6	3.0	11.1	74.1	72.5	263	do	do	do	1.94	.78	1.69	6.65	.330	10.01	9.48	2.92	5.14	8.06	36.23	2.97
14493	60.6	2.9	11.1	71.6	70.3	271	Hard	do	Very creamy	2.00	.59	1.28	6.71	.174	9.43	8.71	2.49	5.19	7.68	36.42	3.47
14496	58.3	4.4	10.6	72.7	69.5	273	Soft	Soft	White	.78	.47	1.73	6.63	.328	12.13	10.98	3.55	6.10	9.65	36.79	1.46

TABLE 63.—*Wheats grown in Greece: Baking properties of the variety samples described in Tables 61 and 62*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Mins.	*Mins.*	*P. ct.*	*C. c.*	*Gm.*	*Score*	*Score*					*Pounds*
14495	160	44	60.4	1,270	502	62	15	Very poor, crumbly	Very, very creamy	Light brown	Very poor	289
14494	142	63	65.2	1,750	527	78	86	Fair	do	Foxy brown	do	304
14493	104	64	59.8	1,610	511	70	76	Poor	do	do	do	295
14496	136	57	54.4	1,880	496	86	86	Poor, crumbly	Light creamy, gray	Brown	Fair	286

Two of the three varieties of durum wheat were of average milling quality; the third variety, Camboura, was below average quality. The flour milled from the durum varieties was typical of durum wheat flour, being granular in texture, high in ash content, and of a light-yellow color.

The milling quality of the wheat labeled Katranitsa was only average.

The bread-making qualities of the flour milled from the durum varieties was not good. A small loaf of very coarse texture was obtained from each baking. The bread baked from the flour milled from the variety Deves, sample 14495, was decidedly poor in baking strength, even though the flour contained a very high percentage of protein.

As compared with the durum wheats produced in North America or Russia, the durum wheats of Greece are most noticeably weak in gluten quality.

HUNGARY

Wheat is the outstanding cereal in Hungary. The trend of wheat acreage is upward and now stands slightly above the pre-war level. The heaviest areas of production are in the west and southwest of Hungary. In 1928 a production of 99,211,000 bushels exceeded the pre-war average by approximately 28,000,000 bushels. Exports of Hungarian wheat amount to about 20,000,000 bushels annually, large quantities of it going to Austria and Czechoslovakia. The climate of Hungary greatly influences the production and quality of the wheats, as it is marked by extremes of temperature and rainfall. Drought is harmful in the autumn, winter, and spring, being most severe in the spring. In the autumn, drought delays seeding and leaves the plants susceptible to winterkilling. Low temperatures in the autumn and in the spring are also harmful. Summer storms frequently cause lodging, and on the plains of Theiss, scalding is especially damaging, as the May temperature frequently reaches 86° F.

The native wheats are relatively hardy but are not high yielding. They have been improved by selection until the following varieties are becoming acclimated: Eszterháza, Hatvan, Bánkut, Szekacs, and Ozora. White winter, white spring, club, and durum wheats are not grown in Hungary to any considerable extent.

Through the courtesy of John Surányi, agronomist of the agricultural experiment station for plant industry at Nagyarovar, Hungary, samples of four varieties—Eszterháza No. 18, Eszterháza No. 163, Bánkut No. 5, and Hatvan No. 1153—were obtained. Results of the grading, milling, and baking tests are given in Tables 64, 65, and 66.

When the samples were examined upon arrival in the United States, the varieties Eszterháza No. 18 and Hatvan No. 1135 were classified as soft red winter wheats, the variety Bánkut was classified as a hard red winter wheat; the variety Eszterháza No. 163 was classified as a hard red spring wheat.

As a result of the milling tests made on these four varieties, it was evident that the milling quality of three—Bánkut No. 5, Eszterháza No. 18, and Hatvan No. 1153—was exceptionally good. The milling quality of the variety Eszterháza No. 163, the spring wheat variety, was noticeably lower.

All the flours were deficient in baking quality, as evidenced by the short fermentation time of the dough and the small size, poor color, and coarseness of the loaf of bread baked from dough.

TABLE 64.—*Wheats grown in Hungary: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14103	Agricultural experiment station, Magyarovar.	Eszterbáza No. 163	Hard red spring	2 Northern Spring	0	50.2	60.5	3.1	3.6	0
13992	do	Bánkut No. 5	Hard red winter	2 Hard Winter	0	53.3	59.7	3.6	1.4	0
14104	do	Eszterháza No. 18	Soft red winter	2 Red Winter	0		59.7	4.6	.6	0
14210	do	Hatvan No. 1153	do	do	0		60.2	4.5	3.0	0

TABLE 65.—*Wheats grown in Hungary: Milling properties of the variety samples described in Table 64, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour—		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14013	62.5	2.3	10.0	70.1	67.4	280	Hard	Granular	White	1.15	0.61	2.04	6.57	0.427	12.26	11.01	4.09	5.31	9.40	43.51	2.26
13992	61.8	1.1	10.8	72.6	71.8	265	Semihard	Soft	do	1.51	.49	1.53	6.57	.268	10.52	9.87	3.68	4.82	8.05	45.71	1.88
14104	60.6	2.5	8.7	73.5	71.7	259	Soft	do	do	1.02	.49	1.62	6.59	.227	10.81	9.38	3.11	4.86	7.97	39.02	1.98
14210	61.9	1.9	9.5	72.6	71.3	263	Semihard	do	do	1.73	.47	1.76	6.30	.589	9.93	8.89	2.84	4.64	7.48	37.97	2.34

TABLE 66.—*Wheats grown in Hungary: Baking properties of the variety samples described in Tables 64 and 65*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14103	134	61	57.8	2,000	509	81	76	Good, crumbly	Creamy, gray	Light brown	Poor	293
13992	120	68	56.6	1,910	501	87	80	Fair, crumbly	Creamy	do	Fair	289
14104	111	59	53.2	1,770	491	82	70	do	do	do	Poor	283
14210	116	63	56.8	1,740	503	78	76	Poor	Creamy, gray	Pale	do	290

IRELAND

IRISH FREE STATE

The acreage under wheat in Ireland has declined rapidly and continuously, from 1847, when the maximum acreage was 671,500 acres, to 1925, when the acreage was 22,000 acres—the lowest figure yet recorded for this crop. Since 1925 there has been a small but significant increase in production, and in 1927 the area devoted to wheat production was 34,500 acres. In 1928 the acreage devoted to wheat in the Irish Free State was 31,500 acres. The principal causes for the decline are the ease of procuring grain in large quantities from overseas countries; the relatively low price, better quality, and lower moisture content of imported grain; and the changes in the agricultural system in Ireland toward increased production of livestock and livestock products.

Climatic conditions are less favorable to the production of wheat in the Irish Free State than to oats and barley. The rainfall is high, and difficulty is experienced in preparing the land and in sowing large acreages of wheat. In former years this difficulty did not arise to the same extent, as wheat was then widely grown in small plots, much of the cultivation being done by manual labor.

According to M. Caffrey, acting head of the seed-propagation division of the University of Dublin, the following varieties of wheat are of commercial importance in the Irish Free State: White Stand-Up, Queen Wilhelmina, Yeoman, Red Chaff, White, Squareheads Master, Red Fife, and April Red. The varieties White Stand-Up and Wilhelmina probably constitute 70 per cent of all the wheat grown. Both fall and spring plantings are made. Sowings to winter wheat take place in October and November. In some of the southern areas winter varieties are sown as late as the first week in February. Sowings of spring wheat are made in March and in the beginning of April. Harvesting extends from mid-August to mid-September.

The Department of Agriculture of the Irish Free State is giving considerable attention to the propagation of improved varieties of wheat for cultivation. Two of these—Red Stettin 13 and Cooney Island—are said to produce flour of excellent baking strength. Neither, however, were grown in a commercial way in 1927.

Through the courtesy of the Department of Agriculture in Dublin, samples of the varieties Yeoman, Red Stettin 13, and Cooney Island, were obtained for milling and baking studies, from wheat grown at the Albert Agricultural College Farm, Glasnevin, Leinster County, in 1926. It was stated that the crop year was very bad. Data resulting from the tests made on these varieties of wheat are given in Tables 67, 68, and 69.

TABLE 67.—*Wheats grown in Ireland: Description and characteristics of the variety samples*

Laboratory No.	County where grown	Variety	Predominating class	Grade	Dockage	Kernal texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14231	Down [1]	Squareheads Master	Soft red winter	1 Red Winter	0.1		60.0	4.3	1.8	0.3
14232	do	Yeoman	do	2 Red Winter	.0		58.5	3.6	2.0	.1
14233	Armagh [1]	Red Chaff Red	do	do	1.5		59.6	4.5	1.4	.1
14230	Down [1]	Benefactor	White	3 Soft White	1.0		57.1	4.3	4.2	.0
14486	Leinster [2]	Yeoman II	Soft red winter	2 Red Winter	.0		59.7	4.1	.5	.0
14488	do	Cooney Island	do	do	.0		60.8	4.8	2.2	.0
14487	do	Red Stettin 13	do	do	.3		61.7	4.1	4.0	.0

[1] Northern Ireland. [2] Irish Free State.

TABLE 68.—*Wheats grown in Ireland: Milling properties of the variety samples described in Table 67 and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14231	60.7	2.1	9.6	68.6	67.2	279	Very soft	Very soft	White	0.95	0.58	1.51	6.44	0.464	7.76	6.80	2.10	3.17	5.27	39.85	2.96
[1] 14232															7.43						
14233	60.8	4.9	9.3	67.2	65.2	286	Very soft	Very soft	White	1.05	.48	1.56	6.44	.481	8.79	7.72	2.40	3.97	6.37	37.68	2.16
14230	58.0	3.3	9.5	65.1	63.6	295	Soft	Soft	do	.85	.51	1.51	6.43	.388	6.93	5.73	1.93	2.45	4.83	39.96	2.43
14486	59.9	1.7	11.5	72.6	71.3	269	do	Very soft	do	.78	.40	1.66	6.45	.480	8.63	7.57	2.49	3.94	6.43	38.72	2.43
14488	62.1	1.0	10.8	69.7	65.9	288	do	Soft	do	.76	.45	1.74	6.55	.359	8.51	7.89	2.33	4.37	6.70	34.78	2.30
14487	62.4	2.0	11.8	72.9	71.7	268	do	Very soft	do	.90	.48	1.82	6.49	.368	10.95	10.21	2.97	5.82	8.79	33.79	2.45

[1] Sample too small for milling purposes.

TABLE 69.—*Wheats grown in Ireland: Baking properties of the variety samples described in Tables 67 and 68*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14231	106	57	52.9	1,720	491	82	70	Poor	Creamy, gray	Pale	Poor	283
[1] 14232												
14233	103	55	54.3	1,730	497	81	75	Poor	Creamy, gray	Pale	Poor	287
14230	100	58	53.1	1,710	492	85	68	do	Creamy	do	do	284
14486	112	62	57.3	1,700	500	84	82	Poor, crumbly	Light creamy, gray	do	do	288
14488	110	60	52.8	1,630	488	86	82	Very poor, crumbly	do	Very pale	do	281
14487	112	58	54.9	1,760	489	83	84	Poor, crumbly	Creamy, gray	Light brown	do	282

[1] Sample not milled, or baked.

115439°—30——9

The milling quality of the varieties Yeoman II and Red Stettin 13 was very good; that of Cooney Island was well below the average for this class of wheat.

The baking strength of all the wheats was weak, the weakness of Cooney Island being more noticeable than that of Yeoman II and Red Stettin. Yeoman II was the best variety in baking strength.

NORTHERN IRELAND

In Northern Ireland the trend of wheat production has been markedly downward since 1860, when 78,000 acres were devoted to its cultivation. In 1925 only 4,000 acres were devoted to wheat; in 1928, 5,000 acres were used.

Excessive rain in the autumn, winter, and spring is the chief hindrance to wheat growing. Insufficient sunshine during the summer likewise hinders the production of high-quality wheat.

Varieties of wheat similar to those grown in England and Scotland are found in Northern Ireland. Squareheads Master represents about 45 per cent of the winter wheat. The variety Yeoman is grown both as a winter and spring wheat and represents about 20 per cent of the winter-wheat acreage. Benefactor represents about 20 per cent of the winter-wheat acreage. There is a local variety known as Red Chaff Red, the characteristics of which have not been described.

Through the courtesy of Ian W. Seaton, of the Ministry of Agriculture at Belfast, sufficient sample material of the four prominent varieties mentioned was sent for milling and baking purposes. The samples represented Benefactor, Squareheads Master, and Yeoman, grown at Dromara, County Down, Northern Ireland and Red Chaff Red, grown at Armagh, county of Ulster.

Unfortunately, because of loss in transit, not enough of the sample of the variety Yeoman was received to make a milling and baking test possible. Of the three other varieties, Squareheads Master had the highest milling quality, followed in order by Red Chaff Red and Benefactor.

From a baking standpoint, the flour milled from the local variety appeared to be slightly greater in strength than the flour milled from the other two varieties.

From a milling standpoint the quality of the wheat grown in the Irish Free State is similar to that raised in England and Scotland. As to baking strength, the flour milled from the wheats of either the Irish Free State or Northern Ireland is somewhat superior to that of the flour milled from wheats raised in England and Scotland. Flour from wheat of similar classes grown in North America has much greater baking strength.

ITALY

The trend in wheat acreage has been upward during recent years and now stands above pre-war figures. Production in the five years 1924–1928, inclusive, averaged over 210,000,000 bushels annually. About 43 per cent of the land in Italy is arable, and of this about 54 per cent is in cereals. Approximately 67 per cent of the cereal acreage is sown to wheat.

Italy's imports of wheat make up over one-fourth of its requirements. In 1927–28 the quantity imported was nearly 88,000,000 bushels.

Wheat is grown under a wide variety of conditions. The most dense wheat areas are in the north of the peninsula in the compartments of Emilia and The Marches and in the extreme south of the island of Sicily. Approximately 20 to 25 per cent of the production consists of durum wheat. This class of wheat is largely produced in the southern half of the country, the heaviest acreages being in Compania and on the island of Sicily. A small quantity of durum wheat is produced along the northeastern Adriatic coast. Wheat yields are higher in the northern sections than in the southern sections, but the acreage trend is more strongly upward in the southern sections than in the north. The wheat grown in Italy is predominantly of common type (*Triticum vulgare*). It is of winter habit, with some exceptions in the north and at the higher altitudes.

Through the cooperation and courtesy of the Creal Culture Institute of Pisa and the Institute of Cereal Culture at Bologna, Italy, samples were obtained of a number of the important wheat varieties grown in Italy.

The varieties sent from Pisa with notes on their relative importance and distribution were the following: (1) Dauno 8, a variety of durum wheat cultivated in southern Italy, on the islands, and in some districts of the Provinces of Latium and Maremma; (2) Campio 4, the predominating soft red winter wheat variety grown in the Province of Lucca, Tuscany, most suitable for lands of poor-to-medium fertility and for localities susceptible to rust; (3) Ardito, a bearded soft red winter variety grown widely throughout Italy, particularly in the Po Valley on very fertile land; (4) Carlotta Strampelli, a soft red winter variety grown extensively some years ago in northern and central Italy on soils of medium-to-good fertility, but now being replaced by such varieties as Inallettabile and Ardito Gentil Rosso; (5) Cascola, a soft red winter wheat adapted to lands of medium-to-poor fertility, and most widely grown in Tuscan Maremma; (6) Gentil Rosso Aristato 8, a soft red wheat suitable for land of poor-to-medium fertility, grown on the Pisan plain; (7) Rieti 11, a soft red winter wheat cultivated in the central and northern sections of Italy on medium-fertile land and in sections where rust is prevalent; (8) Varrone, a soft red winter wheat grown only in the fertile soils of the plains of central and northern Itlay; (9) Gentil Rosso, the most prominent soft red winter wheat grown in central and northern Italy, especially suitable for hilly land of good fertility, and also used toward the end of the winter as a spring wheat; (10) Gentil Rosso 46, a soft red winter wheat of late-maturing habit, adapted to plain or hill country in Tuscany and in Umbria and in other parts of northern and central Italy; (11) Gentil Rosso Semiaristato 48, a soft red winter wheat widely grown with good results in northern and central Italy; (12) Inallettabile 96, a soft red winter wheat variety, widely grown in the fertile sections of northern and central Italy on account of its high productivity, early maturity, and disease resistance (this variety has replaced Inallettabile 38, and Vilmorin Originario); (13) Vilmorin Originario, a soft red wheat resistant to lodging, but late maturing and susceptible to rust; (14) Rusciola, a soft red winter wheat grown especially in The Marches and in Umbria; (15) Vittorio Veneto, a soft winter wheat still in the introductory stage; (16) Inallettabile 3, a soft wheat, with white kernels, grown widely on the fertile lands of the Tuscan plain; (17) Inallettabile 8, a white wheat of good pro-

ductivity and rust resistance but only sparsely grown; (19) Mentana, a white wheat of good productivity and early maturity, of increasing popularity, grown extensively on fertile land in central and northern Italy; (20) Duro di Randazzo, a Polish variety cultivated in some districts of Sicily and Maremma; (21) Civitella 65, a poulard variety most widely grown in Tuscan Maremma, suitable for firm and slightly damp ground; and (22) Mazzocchio, a poulard variety largely cultivated in the hilly parts of Tuscany, particularly in the Province of Florence.

The sample of the variety Cologna 31, a red winter wheat grown in Venetia, Piedmont, and Emila, and to a lesser extent elsewhere, was received from the Cereal Culture Institute at Bologna. Other varieties represented by samples from this institute were Inallettabile 96, previously described; Marzuola 87, a spring wheat coming into common cultivation; Ardito, previously described; and two varieties of durum wheat, one of the variety Cencelli of Strampelli, and the other of the variety name Saragolla.

The milling and baking data resulting from the study of the Italian varieties are shown in Tables 70, 71, and 72.

TABLE 70.—*Wheats grown in Italy: Descriptions and characteristics of the variety samples*

Laboratory No.	Source of sample [1]	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent.*	*Per cent*
13872	Rome [2]	Dauno 8	Durum	2 Amber Durum	0.6	91.6	59.5	5.5	0.0	0.0
14121	Bologna [3]	Saragolla	do	do	.0	92.4	63.6	5.2	.4	.0
14122	do	Cencelli	do	3 Amber Durum	.0	86.4	60.5	5.0	4.4	.0
13882	Rome	Campio 4	Soft red winter	1 Red Winter, garlicky	.0		61.4	5.0	.2	.0
14119	Bologna	Ardito	do	1 Red Winter	.0		61.2	3.8	.1	.0
14120	do	do	do	2 Red Winter	.0		59.5	3.5	1.2	.0
13877	Rome	do	do	do	.0		59.2	4.4	.4	.0
13874	do	Carlotta	do	do	.0		58.5	5.1	3.8	.0
13880	do	Cascola	do	do	.0		58.5	3.8	.6	.8
14114	Bologna	Cologna 31	do	do	.0		59.3	5.1	.5	.0
14113	do	do	do	do	.0		59.0	4.9	.5	.0
13886	Rome	Gentil Rosso Aristato 8	do	do	.0		59.7	4.8	1.6	.0
13883	do	Rieti 11	do	do	.0		60.0	5.2	2.2	.0
13885	do	Varrone	do	do	.2		58.2	4.7	.4	.0
13879	do	Gentil Rosso Semiaristato 48	do	3 Red Winter	.2		56.0	4.3	1.0	.0
13875	do	Gentil Rosso Noe 46	do	3 Red Winter, garlicky	.0		57.8	4.5	.4	.0
13873	do	Gentil Rosso	do	3 Red Winter	.0		57.9	4.2	1.2	.0
14116	Bologna	Inallettabile 96	do	do	.0		57.7	4.2	1.0	.0
14115	do	do	do	do	.0		56.6	4.5	.4	.0
13878	Rome	do	do	do	.0		56.5	3.7	.5	.0
13887	do	Inallettabile 38	do	do	.0		56.5	4.5	.5	.0
14118	Bologna	Marzuolo 87	do	do	.0		57.2	3.6	.3	.0
14117	do	do	do	do	.0		59.4	5.1	4.6	.0
13889	Rome	Rusciola	do	do	.0		57.4	3.9	1.7	.2
13884	do	Vilmorin Origario	do	do	.1		56.0	4.4	.5	.0
13881	do	Vittorio Veneto	do	4 Red Winter	.0		55.5	3.5	7.0	.0
13890	do	Inallettabile 8	White	2 Hard White	.0	92.8	59.4	4.4	.0	.0
13892	do	Inallettabile 3	do	3 Soft White	.0	69.9	57.8	4.6	.3	.0
13891	do	Mentana	do	do	.0	53.4	56.9	3.5	.2	.0
13871	do	Duro di Randazzo	Polish		.0	98.0	57.1	6.3	1.3	.0
13870	do	Civitella 65	White poulard		.0	8.2	57.0	4.4	.1	.0
13888	do	Mazzocchio	Red poulard		.0		56.3	4.5	.0	.0

[1] Region where grown not known.
[2] Obtained through the courtesy of Asher Hobson.
[3] Obtained through the courtesy of the Societa Bolognese.

TABLE 71.—*Wheats grown in Italy: Milling properties of the variety samples described in Table 70, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angel b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13872	59.3	3.7	10.4	71.6	69.4	273	Very hard	Granular	Very creamy	3.07	0.95	1.89	6.52	0.439	11.93	11.19	4.25	5.16	9.41	45.16	2.77
14121	63.7	2.5	10.6	70.0	68.3	277	do	do	Creamy	1.69	.70	1.43	6.59	.242	11.73	10.82	3.48	5.86	9.34	36.56	3.04
14122	60.8	3.5	10.5	71.1	68.6	276	do	do	do	1.85	.91	1.49	6.53	.276	10.56	9.09	3.09	5.13	8.22	37.26	3.06
13882	62.3	1.1	12.8	73.5	72.7	207	Soft	Soft	White	1.18	.52	1.78	6.44	.328	11.09	10.11	3.75	4.78	8.53	43.96	2.54
14119	62.3	1.6	10.3	69.1	68.0	278	do	do	do	1.33	.47	1.73	6.46	.801	11.69	10.77	3.66	5.67	9.33	36.01	2.02
14120	61.2	1.7	10.1	69.9	68.7	275	Tough	Very soft	do	1.19	.45	1.69	6.43	.288	12.71	11.94	3.82	6.63	10.45	39.23	1.93
13877	60.6	1.4	10.6	70.3	69.3	275	Soft	Soft	do	1.08	.51	1.88	6.60	.429	14.02	12.96	4.89	6.44	11.33	43.16	2.00
13874	59.4	2.1	11.5	73.3	71.8	267	do	do	do	1.00	.47	1.68	6.59	.387	12.55	11.12	4.07	5.43	9.50	42.84	2.20
13880	60.1	.9	11.3	69.8	69.2	276	do	do	do	1.09	.50	2.00	6.56	.285	10.28	9.46	3.39	4.67	8.06	42.06	2.02
14114	60.4	3.3	10.3	70.8	68.5	276	do	do	do	.86	.58	1.61	6.49	.289	10.32	9.43	2.98	4.86	7.84	38.01	2.19
14113	59.0	4.1	9.7	73.6	70.5	265	do	do	do	.91	.58	1.45	6.57	.234	11.02	9.86	3.55	4.71	8.26	42.98	1.90
13886	60.9	1.4	11.1	68.6	67.7	282	do	Very soft	do	1.54	.52	1.94	6.56	.357	10.86	10.32	3.77	4.85	8.62	43.74	2.01
13883	60.0	1.4	11.6	71.3	70.3	273	do	Soft	do	1.39	.52	1.91	6.46	.348	10.55	9.30	3.27	4.49	7.76	42.14	2.04
13885	59.6	1.9	11.3	70.6	69.3	276	do	Very soft	do	.81	.49	1.70	6.58	.342	13.20	11.69	3.82	6.29	9.11	41.93	1.98
13879	56.7	2.1	10.5	69.4	67.9	282	do	Soft	do	1.23	.45	1.69	6.49	.304	9.45	8.64	2.98	4.30	7.28	40.93	1.93
13875	58.2	1.3	12.0	69.8	68.9	280	do	do	do	1.79	.50	1.97	6.58	.340	10.28	9.18	3.01	4.07	7.08	47.01	1.91
13873	58.5	2.3	11.3	71.6	70.0	273	do	do	do	1.14	.47	1.71	6.64	.387	9.27	8.52	2.88	4.18	7.06	40.79	2.11
14116	57.8	2.6	10.9	72.0	70.2	271	do	Very soft	do	1.52	.53	1.60	6.32	.281	9.76	9.60	3.11	5.05	8.16	38.11	2.24
14115	55.7	4.9	10.0	69.3	65.9	286	Tough	Soft	do	1.44	.45	1.51	6.60	.236	10.35	9.51	3.31	4.81	8.12	40.76	2.34
13878	57.6	1.8	11.6	70.0	68.7	279	do	do	do	1.68	.44	1.74	6.58	.251	10.92	9.63	3.86	4.27	8.13	47.48	2.19
13887	57.4	2.8	10.6	72.7	70.7	268	Soft	Very soft	do	1.45	.48	1.66	6.58	.315	11.95	11.11	3.95	5.54	9.49	41.62	2.26
14118	58.8	2.7	10.2	69.9	68.0	278	do	Soft	do	1.62	.51	1.62	6.70	.159	13.29	11.47	3.59	6.38	9.97	36.26	1.60
14117	59.7	2.7	10.6	72.0	70.0	271	do	do	do	1.15	.54	1.78	6.51	.382	10.64	9.18	2.85	5.01	7.86	36.26	2.21
13889	59.2	1.7	11.2	71.8	70.6	270	Semihard	Soft	do	1.22	.50	1.75	6.64	.255	10.19	9.67	3.54	4.60	8.14	43.49	2.01
13884	56.9	2.3	11.4	71.9	70.3	272	Very soft	Very soft	do	1.58	.47	1.69	6.39	.367	12.07	10.82	3.96	5.27	9.23	42.90	1.90
13881	58.0	1.4	11.3	68.7	65.8	290	do	do	do	1.54	.44	1.68	6.53	.274	10.67	9.28	3.25	4.64	7.89	41.19	1.88
13890	60.5	.9	11.0	70.1	69.5	274	Soft	do	do	1.34	.44	1.57	6.60	.313	10.71	9.67	3.48	4.53	8.01	43.45	2.03
13892	58.2	1.5	11.0	73.2	72.1	264	do	do	do	1.69	.52	1.67	6.52	.370	10.02	9.18	3.30	4.44	7.74	42.64	2.29
13891	58.4	2.0	10.4	69.9	68.5	276	do	do	do	.85	.47	1.66	6.62	.248	10.02	9.66	3.39	4.59	7.98	42.48	2.42
13871	58.6	4.0	11.1	69.7	66.9	285	Very hard	Granular	Creamy	2.63	.94	1.95	6.52	.443	11.79	11.03	3.70	5.50	9.29	40.80	2.80
13870	57.9	2.7	11.8	70.2	68.3	282	do	do	do	1.99	.79	1.90	6.51	.400	8.39	7.40	2.75	3.09	5.84	47.09	3.04
13888	56.4	3.0	11.3	69.5	67.4	284	Hard	do	White	1.46	.74	1.87	6.60	.347	8.50	7.66	2.49	3.80	6.29	39.59	3.16

TABLE 72.—*Wheats grown in Italy: Baking properties of the variety samples described in Tables 70 and 71*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13872	115	54	62.4	1,520	525	72	28	Fair, crumbly	Very, very creamy	Brown	Poor	303
14121	126	59	66.7	1,830	531	80	85	Excellent	Very creamy	do	do	306
14122	122	43	65.4	1,510	531	74	58	Fair	Very, very creamy	do	do	306
13882	110	54	53.4	1,700	492	80	43	Poor, crumbly	Creamy	do	do	284
14119	105	52	53.5	1,740	502	78	40	do	Very creamy	Light brown	do	289
14120	98	50	55.5	1,940	501	79	47	Poor, crumbly	Creamy, gray	Brown	do	289
13877	100	53	56.2	1,750	505	74	20	Very poor, crumbly	do	do	do	297
13874	99	51	54.1	1,710	499	76	30	do	do	do	do	288
13880	111	54	51.7	1,610	490	85	55	Poor	Light creamy	Light brown	do	282
14114	121	51	52.2	1,690	491	82	44	do	Creamy, gray	do	do	283
14113	109	50	53.0	1,740	494	79	37	do	do	Brown	do	285
13886	103	53	51.5	1,830	490	82	78	Fair, crumbly	Creamy	Light brown	do	282
13883	112	57	52.2	1,750	492	84	46	Poor, crumbly	Light creamy	do	do	284
13885	101	48	52.4	1,620	486	62	24	Very poor, crumbly	Light creamy, gray	Brown	do	280
13879	105	60	51.5	1,820	489	89	77	Poor, crumbly	Creamy	Light brown	do	282
13875	105	55	52.7	1,820	491	85	83	Fair, crumbly	do	do	do	283
13873	106	59	52.2	1,870	489	86	75	do	do	do	do	282
14116	103	54	53.8	1,740	497	79	43	Poor, crumbly	Very creamy	Pale	do	287
14115	105	54	52.8	1,810	493	85	85	Fair	Creamy	do	do	287
13878	104	53	52.2	1,730	493	84	53	Poor	do	Light brown	do	284
13887	101	54	52.8	1,780	493	83	68	Poor, crumbly	do	do	do	284
14118	105	52	54.4	1,930	503	84	76	do	do	do	do	290
14117	105	52	54.6	1,740	500	80	39	do	Creamy, gray	Pale	do	288
13889	103	57	54.2	1,890	494	88	73	do	Light creamy	Light brown	do	285
13884	109	58	51.1	1,800	491	81	52	do	Creamy	do	do	283
13881	110	54	51.2	1,670	487	75	45	Poor	Very creamy	do	do	281
13890	108	52	53.0	1,690	496	84	69	Poor, crumbly	Creamy	do	do	286
13892	105	53	51.5	1,700	488	83	71	do	do	do	do	281
13891	107	54	52.1	1,700	486	89	70	do	Light creamy	do	do	280
13871	132	57	64.0	1,530	536	82	44	Fair	Very creamy	Brown	do	309
13870	108	44	56.6	1,370	504	80	8	Very poor	Creamy	Pale	do	290
13888	125	48	58.4	1,310	568	84	27	Poor	Very creamy	Brown	do	293

The durum varieties were of average milling quality. No outstanding yield of flour was noted. Only one variety, Saragolla, evidenced good baking strength. The other two varieties, Dauno 8 and Cencelli, revealed themselves as of poor baking strength, for the resulting bread was exceptionally low in volume and coarse in texture.

On an average, the milling quality of the soft red winter varieties was good. There were several exceptions, but good yields of flour were obtained in the majority of instances.

Of the white varieties tested, one was of excellent milling quality and two were of average milling quality. The flour milled from all of the red winter wheats was lacking in baking strength; the texture of the bread was never good and was seldom even fair. Volume of loaf was also distinctly below the average for this class of flour in the majority of the tests. That the defects in the resulting loaf were the result of lack in baking strength is further emphasized by the short fermentation tolerance of the doughs, by the low-water absorption of the flour, and by the break and shred of the finished loaf.

The baking qualities of the white wheat varieties were no better than those of the red winter varieties.

As is usual with Polish and poulard wheats, most of the flour was of an inferior baking quality.

LATVIA

Cultivation of wheat in Latvia has increased materially since the pre-war period. According to the Minister of Agriculture, about 0.05 acre of wheat per capita was sown in 1923, whereas before the World War 0.035 acre per capita was sown. There has also been an increase in yield per acre since pre-war times, owing to better seed and cultural methods. Even so, the need for imported wheat is greater than ever. In 1924–25 there was nearly as much wheat imported—1,963,000 bushels—as was produced, indicating a consumption of about 2 bushels per capita. Increased consumption is also stimulated by the replacement of rye by wheat. Wheat production in 1928 was 2,499,000 bushels.

Both spring and winter wheats are produced in Latvia, the winter wheat giving the highest yields. Durum wheat has been tried, but only for a short time.

Late spring frosts constitute the most harmful weather factor so that May is the most critical month in the development of the crop. Hot summers are comparatively rare. Spring wheat is more often damaged by drought than by excessive heat. Excess rains during the late stages of development of the crop as well as during harvest cause losses. The autumn and winter are generally favorable to wheat production.

Samples of five varieties of wheat of commercial importance in Latvia were obtained from the seed-selection station at Stende, through the courtesy of the Department of Agriculture of Latvia. Two of these varieties (samples 15517 and 15519) were described as local summer varieties of spring habit. Wheat represented by sample 15520 was described as a hard summer wheat, and wheats represented by samples 15518 and 15521 were said to be of winter habit. The varieties, listed by selection number as well as their area of distribution are shown in Table 73 with the data on the grading of these samples.

TABLE 73.—*Wheats grown in Latvia* [1]: *Description and characteristics of the variety samples*

Laboratory No.	Region where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
15519	Valmeera	No. P. 128–27	Hard red spring	2 Northern Spring	0.0	36.4	57.7	2.8	2.6	0.0
15517	Tukums	No. P. 3–27	do	1 Red Spring	.1	13.8	59.7	3.4	.6	.0
15520	General in Latvia	No. 9–126–27	Durum	2 Durum	.2	32.1	62.3	3.7	3.9	.3
15518	Seed-selection station, Stende	No. 16–620–27	Soft red winter	3 Red Winter	.0		59.2	3.8	4.8	.0
15521	do	No. 47–615–27	do	do	.0		57.7	3.7	4.9	.0

[1] Crop year 1927.

TABLE 74.—*Wheats grown in Latvia: Milling properties of the variety samples described in Table 73 and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Crude protein in wheat	Crude protein in flour	Glutenin in flour	Glidin in flour	Gluten protein in flour	Glutenin in gluten proteins
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value								
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
15519	59.5	1.8	9.6	71.2	69.9	270	Hard	Granular	Creamy	1.90	0.45	1.78	9.92	8.55	2.92	4.07	6.99	41.77
15517	61.2	1.7	9.7	70.4	69.2	273	Soft	Soft	White	1.23	.50	1.83	9.60	8.41	3.09	3.68	6.77	45.64
15520	62.4	2.4	9.8	75.6	73.8	255	Very soft	Granular	Creamy	1.98	.73	1.73	10.34	9.55	3.37	4.22	7.59	44.40
15518	60.0	3.1	9.6	73.8	71.5	262	Semihard	Soft	White	.99	.41	1.60	11.52	10.38	3.63	5.18	8.81	41.20
15521	58.1	3.3	9.6	70.4	68.0	276	Soft	do	Creamy	2.02	.46	1.43	10.66	9.37	3.23	4.56	7.79	41.46

TABLE 75.—*Wheats grown in Latvia: Baking properties of the variety samples described in Tables 73 and 74*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Gm.*	*Score*	*Score*					*Pounds*
15519	128	57	56.7	1,780	497	76	80	Poor, solid	Very creamy, gray	Light brown	Poor	287
15517	113	54	54.2	1,720	492	78	76	do	Creamy, gray	do	do	284
15520	151	61	57.7	2,010	505	80	90	Good	Very creamy	Brown	do	291
15518	108	57	55.8	1,860	500	86	86	Fair	Creamy	Light brown	do	288
15521	114	61	54.3	1,930	493	78	86	do	Very creamy, gray	do	do	284

The milling quality of all the wheats (Table 74) was very good. The durum variety exhibited the best milling quality, followed in order by the soft red winter wheats and the spring wheats.

The baking quality of the flour milled from the durum wheat (Table 75) ranked first, whereas the baking quality of the flour milled from the other four varieties was of the same order as their milling quality.

LITHUANIA

Production of wheat in Lithuania has increased considerably over the pre-war average. The 1909–1913 average production was 3,264,000 bushels, whereas in 1928 a production of 6,327,000 bushels was estimated. Sowings of wheat in Lithuania are affected chiefly by drought, frosts, and excessive rains. In the spring and summer, frosts and drought on the one hand and frosts and excessive rains on the other markedly influence the growing of wheat.

Common white wheats (*Triticum vulgare*) are the most prominent, although some common red winter wheats are grown. Both classes of wheat are fall sown, from August to mid-September.

For the milling and baking study, samples of five varieties of Lithuanian wheats were obtained through the courtesy of L. Rudzinski, director of the plant-breeding experimental station, Dotnuva, Lithuania. These wheats were not given variety names, and are referred to by serial number. Two varieties were soft red winter wheats, and three were white wheats. All the samples tested were grown at the Moscow plant-breeding station in 1922. Data secured from the analysis of these samples are given in Tables 76, 77, and 78.

TABLE 76.—*Wheats grown in Lithuania: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					P. ct.	*P. ct.*	*Lbs.*	*Gm.*	*P. ct.*	*P. ct.*
13077	Plant-breeding station, Dotnuva.	No. A-2411	Soft red winter	1 Red Winter	0	------	61.8	4.2	0.7	0
13075	----do----	No. 2324	----do----	2 Red Winter	0	------	59.7	4.3	2.6	0
13076	----do----	No. 2671	White	1 Hard White	0	79.2	61.6	4.0	.6	0
13073	----do----	No. 2267	----do----	2 Soft White	0	59.5	59.5	3.7	2.4	0
[1] 13074	----do----	No. 1814	----do----	----------	----	------	------	-----	-----	----

[1] Sample too small for grading, milling, and baking.

TABLE 77.—*Wheats grown in Lithuania: Milling properties of the variety samples described in Table 76, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yields—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Pounds*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13677	62.3	1.8	11.5	68.6	67.4	284	Soft	Soft	White	1.41	0.40	1.65	6.46	0.273	11.67	10.82	4.06	5.12	9.18	44.23	1.62
13675	61.0	1.5	12.0	68.9	67.9	284	do	do	do	1.26	.42	1.63	6.32	.252	11.07	9.98	3.93	4.46	8.39	46.90	1.90
13675	62.0	1.3	10.0	75.7	74.5	253	do	do	Creamy	1.76	.54	1.69	6.56	.366	10.74	10.57	3.40	5.72	9.12	37.28	2.15
13673	60.7	1.8	12.4	72.7	71.4	271	do	do	do	1.39	.41	1.63	6.51	.313	11.66	11.25	3.82	5.11	8.93	42.78	1.95

TABLE 78.—*Wheats grown in Lithuania: Baking properties of the variety samples described in Tables 76 and 77*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per Cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13677	101	55	55.1	1,840	493	86	35	Poor, crumbly	Creamy, gray	Light brown	Poor	284
13675	113	59	54.5	1,960	489	89	82	Fair, crumbly	Creamy	do	Fair	282
13675	100	40	54.5	1,560	499	72	32	Poor, crumbly	Very creamy	Brown	Poor	288
13673	100	52	55.0	1,900	491	86	68	Fair, crumbly	do	Light brown	Fair	283

The soft red winter wheat varieties were below the average in milling quality. On the other hand, the milling quality of the white wheats was very good. This is particularly true of the variety No. 2761.

The baking quality of one variety of soft red winter wheat, No. A–2411, was noticeably weak. That of its mate, sample No. 2524, was much better. Although the variety No. 2761 had an excellent milling performance, its baking properties were very poor—poorer than any of the other varieties. The second white wheat variety, No. 2267 had slightly weaker properties than did the red winter variety No. 2524. Blending with stronger imported wheats would be helpful in stabilizing the baking strength of Lithuanian wheats. Otherwise they would be more useful if made into biscuits, crackers, or pastry.

NETHERLANDS

Annual production of wheat in the Netherlands averages about 6,000,000 bushels, of which only a small portion is used for home consumption. Most of the home-grown wheat is used for mixing with strong imported wheats, of which some 30,000,000 bushels are used annually in order to regulate the baking quality of the flour milled from the wheat grown in the Netherlands. Some of the wheat grown in the Netherlands is exported, largely to Belgium and Germany for mixing purposes and for biscuit making.

The Provinces that produce wheat, in the order of their importance in acreage according to the average figures for the crop years 1921–1925, are Zeeland, Groningen, South Holland, North Holland, Limburg, North Brabant, Gelderland, Friesland, Utrecht, and Overijssel. More than half of the wheat crop is fall sown.

Wilhelmina, the chief winter variety, is a white wheat. Production of this variety is on the increase because of its winter resistance, high productivity, and good quality. There are other winter wheat varieties, but at least 75 per cent of them are derivatives of Wilhelmina, and their quality is similar.

Red winter wheat is not popular with the farmers of the Netherlands because the Dutch trade does not like red wheats. Consequently little is grown, although small acreages are found in the Provinces of Limburg and Zeeland.

Spring wheat is little grown in the Netherlands. It is found principally in the northern part of the country in sections where winter wheat has been winterkilled or could not be sown on account of bad weather. About 80 per cent of the spring wheat in the Netherlands is grown in the Province of Groningen. A small acreage of spring wheat is also found in North Holland. The most important spring variety is Japhet.

On request, samples of several of the more important varieties of wheat grown in the Netherlands were received from the Director General of Agriculture, at S'Gravenhage, and were subjected to the milling and baking tests previously described.

Samples of three winter varieties—Wilhelmina, Algebra, and Witte Dikkop III—were sent from the Province of Groningen. All are white wheats. The variety Wilhelmina represents 55 per cent of the wheat acreage in Groningen. Twelve per cent of each of the varieties Algebra and Witte Dikkop III was also grown in Groningen.

Samples of three winter varieties and one spring variety were sent from the Province of North Holland. These consisted of a second sample of Wilhelmina, one sample each of the white varieties Imperial II–A and Millioen III, and a sample of the spring-sown variety Japhet-Zomertarwe.

Seventy-seven per cent of the wheat acreage in North Holland is sown to Wilhelmina, 10 per cent to the variety Imperial II–A, 10 per cent to the spring variety Japhet-Zomertarwe, and 2 per cent to the variety Millioen III.

From the Province of Zeeland, samples of three winter varieties were sent— Wilhelmina, Millioen III, and Pantser III. In the Province of Zeeland over 85 per cent of the acreage is sown to Wilhelmina, 5 per cent to Millioen III, and 2.5 per cent to Pantser III. Pantser III is a red winter wheat of Swedish origin. Data relative to the grading, milling, and baking tests are given in Tables 79, 80, and 81.

Whereas it was possible to mill out a large quantity of flour from the wheats grown in the Netherlands, this flour lacked baking strength to a very noticeable degree, as was true with the wheats grown in Belgium, England, Ireland, and Scotland. Loaves of bread made from such flour were small in size, coarse in texture, and of a very pale external appearance. It is apparent that the flour milled from wheat grown in the Netherlands is better adapted to the making of biscuits, crackers, and such commodities in which gluten of good strength is not essential. This weakness is apparently recognized by the millers of the Netherlands as they import 30,000,000 bushels of wheat from overseas for blending and mixing purposes.

TABLE 79.—*Wheats grown in Netherlands: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13976	Groetpolder	Japhet-Zomertarwe	Hard red spring	3 Red Spring	0.0	8.0	59.8	4.8	5.5	0
13977	Wolfaartsdijk	Pantser III	Soft red winter	3 Red Winter	.0		57.9	3.9	.3	0
13978	Beerta	Algebra	White	3 Hard White	.0	86.3	57.7	3.6	5.1	0
13982	Westpolder	Witte Dikkop III	do	do	.0	88.0	58.5	4.3	4.7	0
13981	[1]	Millioen III	do	2 Soft White	.1	23.2	58.1	4.2	.6	0
13979	[2]	Wilhelmina	do	do	.0	23.4	58.6	3.8	1.3	0
13980	Anna Paulowna-Polder	Imperial II-A	do	do	.0	10.4	58.3	4.1	.6	0

[1] Composite of two samples, the one grown at Groetpolder and the other at Kapelle (Willem Annapolder).
[2] Composite of three samples grown at Roodeschool, Anna Paulowna-Polder, and Rillard-Bath (Bathpolders), respectively.

TABLE 80.—*Wheats grown in Netherlands: Milling properties of the variety samples described in Table 79, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle *b*)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Pounds	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13976	60.4	2.2	10.4	72.5	70.9	267	Soft	Very soft	White	1.61	0.47	1.69	6.52	0.444	10.18	9.28	3.24	4.48	7.82	41.43	2.14
13977	58.8	1.4	9.5	71.8	70.8	265	do	do	do	1.60	.54	1.73	6.53	.454	8.03	7.44	2.85	3.16	6.01	47.42	2.33
13978	58.7	2.1	10.3	69.0	67.5	280	do	Soft	do	2.16	.53	1.88	6.43	.458	11.76	10.73	3.87	5.39	9.26	41.79	2.27
13982	60.8	1.6	10.5	72.2	71.1	266	do	do	do	1.18	.53	1.70	6.55	.314	11.71	10.53	3.79	5.23	9.02	42.03	1.83
13981	59.5	1.7	10.7	72.4	71.2	267	do	do	do	1.63	.46	1.78	6.61	.373	8.74	7.65	2.89	3.47	7.65	45.44	2.33
13979	59.5	1.7	10.3	72.3	71.2	266	do	do	do	2.14	.45	1.66	6.55	.304	8.79	7.89	2.81	3.77	6.58	42.71	2.10
13980	58.9	2.1	10.2	72.5	70.2	269	do	do	do	1.78	.55	1.53	6.48	.356	8.69	8.09	3.10	3.45	6.55	47.33	2.27

TABLE 81.—*Wheats grown in Netherlands: Baking properties of the variety samples described in Tables 79 and 80*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13976	89	47	54.5	1,640	500	72	34	Poor, crumbly	Creamy, gray	Light brown	Poor	288
13977	94	46	51.3	1,580	488	74	32	do	do	Pale	do	281
13978	96	47	52.3	1,730	493	71	30	do	Very creamy	Brown	do	284
13982	96	45	55.0	1,590	501	72	18	Very poor	Creamy, gray	Light brown	do	281
13981	100	49	51.0	1,660	489	83	47	Poor	Creamy	Pale	do	282
13979	103	50	51.1	1,710	489	73	32	Poor, crumbly	Very creamy	do	do	282
13980	103	48	51.3	1,620	490	75	31	Poor	Creamy, gray	do	do	282

NORWAY

Production of wheat has increased in Norway since the World War. Wheat now occupies 5 per cent of the total acreage devoted to cereals, whereas in 1913 the acreage devoted to similar purposes was only 3 per cent.

The main wheat area lies south and west of Oslo (Christiania) and comprises the Prefectures (Fylke) of Ostfold, Akershus, Buskerud, Vestfold, and Telemark. These prefectures produce about 75 per cent of the wheat grown in Norway.

The chief factors adverse to the growing of wheat are excessive rain in western Norway, low temperatures, and short summers.

About 98 per cent of the wheat grown in Norway is spring wheat. Practically all the spring wheat varieties in use are native. They are all early-maturing forms of common wheat, having long, lax, flattish, red heads and hard red kernels.

There are two main types of Norwegian spring wheat: The Borsum type, with awnless ears (*Triticum vulgare* variety *milturum*), and the bearded Ostby type (*Triticum vulgare* variety *ferrugineum*). Varieties of the first type are predominant throughout the entire spring-wheat area. The second type is grown to some extent in the Prefecture of Vestfold, and more sporadically in other districts.

Winter wheat is grown to a limited extent in the districts surrounding Oslofjord. The most commonly grown winter wheats are native varieties.

In order to compare the milling and baking qualities of the more important Norwegian wheat varieties, five samples were obtained from the Norwegian Department of Agriculture. Three of these—Borsum wheat, Ostby wheat, and Aas wheat—represented commercial types. The two other varieties, J. 03 and Mo. 07, are pure varieties of spring wheat being developed by Knut Vik, of the School of Agricultural Science, University of Norway. The variety J. 03 is a development from a native spring wheat; Mo. 07 originated from Montana wheat. In the United States these wheats would be classified as spring wheats. Data relative to their milling and baking properties are given in Tables 82, 83, and 84.

The milling quality of the Norwegian wheat varieties was good, as they all produced a high percentage of flour and were of high-test weight per bushel. Their protein content was not high and was somewhat below that usually associated with spring-wheat varieties.

As to baking strength, the flour milled from all the varieties was outstandingly weak. The loaves of bread made from these flours were small in volume, poor in color, and very coarse in texture and grain of crumb. The baking strength of the variety Aas was noticeably poor. As compared with wheats of the same class grown in North America and in Russia, the baking quality of the Norwegian wheats is inferior.

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TABLE 82.—*Wheats grown in Norway: Description and characteristics of the variety samples*

Laboratory No.	Region where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14578	Sörcosthandet	Börsum	Hard red spring	1 Hard Spring	0	93.6	62.4	3.2	0.1	0.0
14582	University of Norway [1]	Mo. 07	do	do	0	87.4	61.8	3.4	1.0	.0
14580	do	Ans	do	1 Dark Northern Spring	0	75.9	61.7	3.1	.9	.4
14579	Vestfold Fylke	Östby	do	Sample Dark Northern Spring	0	96.1	59.6	3.7	[2] 38.8	.2
14581	University of Norway	J. 03	do	1 Northern Spring	0	55.4	62.9	2.8	1.2	.1

[1] School of Agricultural Science. Pure varieties.

[2] Frost damaged.

TABLE 83.—*Wheats grown in Norway: Milling properties of the variety samples described in Table 82, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gertner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14578	63.6	0.8	11.7	70.9	70.4	273	Hard	Granular	White	1.21	0.57	1.88	6.61	0.401	11.28	10.71	3.06	5.11	8.77	41.73	2.10
14582	63.0	1.5	11.7	74.0	72.9	263	do	do	Creamy yellow	2.16	.66	2.01	6.55	.534	11.13	10.18	3.60	4.86	8.46	42.55	2.00
14580	63.1	1.0	11.9	70.7	70.1	275	do	do	Creamy	1.81	.62	1.90	6.57	.480	9.08	8.16	2.71	3.98	6.69	40.51	2.05
14579	60.5	1.3	12.4	71.5	70.6	274	do	do	White	.91	.62	1.87	6.67	.371	12.70	11.70	3.97	6.03	10.00	39.70	2.12
14581	64.6	.9	11.7	70.2	69.5	276	do	do	do	1.23	.61	1.91	6.60	.479	10.02	8.90	2.92	4.19	7.11	41.07	2.23

TABLE 84.—*Wheats grown in Norway: Baking properties of the variety samples described in Tables 82 and 83*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14578	147	50	62.1	1,690	518	78	75	Very poor, crumbly	Creamy	Light brown	Very poor	299
14582	150	56	57.6	1,700	501	76	72	do	Very creamy	Brown	do	293
14580	153	52	57.4	1,520	501	80	60	do	Creamy	Light brown	do	293
14579	156	48	67.1	1,780	531	70	86	Fair	Creamy, dark gray	Brown	Poor	306
14581	163	54	58.4	1,760	504	80	82	Poor, crumbly	Creamy	Light brown	Very poor	291

POLAND

Acreage devoted to wheat production in Poland has shown a moderate upward trend since the World War, but has not yet attained pre-war levels. Wheat occupies only about 5 to 6 per cent of the cultivated area. Importations of wheat usually cover from 10 to 30 per cent of the country's requirements. The most intensive wheat area is in southeastern Poland, but the highest yields are obtained in northwest Poland. The climate of Poland is characterized by dry falls and cold springs and summers that are almost always too wet for wheat culture. Winter wheats predominate, although durum and spring wheats are grown. Sowing takes place in the central and southern districts during early September, but in the eastern section it is considerably earlier. White wheats predominate and are grown in all sections, especially in the north and central portions, because of their resistance to winter killing. Swedish red winter wheats are popular as they are even more resistant to cold than are the white wheats.

Samples of four varieties of wheat, all of the 1926 crop, identified by number, were received from the Government Institute of Agricultural Research, located at Pulawy, Poland. Only three were large enough to mill. Classified according to their kernel characteristics one represented a spring-wheat variety, one a durum variety, and one a white variety.

These samples were graded, milled, and baked as usual. The resulting data are given in Tables 85, 86, and 87. Each variety was of good milling quality. The test weight per bushel was excellent and the yield of flour a little better than average for the class of wheat in question. From a baking standpoint, however, the flour from only the white variety approached the qualifications of a good flour. The loaf of bread baked from the spring-wheat flour, although of good volume, showed that the flour lacked strength and stability, as the texture and grain of the crumb were poor. The same facts are true for the flour milled from the durum variety. From the meager data at hand, it would appear that Polish wheats should be blended with imported wheat to regulate their baking quality.

TABLE 85.—*Wheats grown in Poland: Description and characteristics of the variety samples*

Laboratory No.	Locality where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14189	Government Institute of Agricultural Research, Pulawy.	No. 108	Hard red spring	1 Dark Northern Spring	0	75.0	60.3	3.4	1.0	0
14187	do	Durum	Durum	2 Amber Durum	0	81.4	62.1	4.4	3.2	0
14188	do	No. 217	White	1 Soft White	0	54.2	60.6	3.6	.0	0
[1] 14209		No. 179								

[1] Sample too small for milling purposes.

TABLE 86.—*Wheats grown in Poland: Milling properties of the variety samples described in Table 85, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14189	61.8	1.8	9.7	68.9	67.6	278	Soft	Very soft	White	1.19	0.56	1.17	6.43	0.442	13.02	12.93	3.92	7.17	11.09	35.35	1.55
14187	62.9	2.2	10.0	72.6	71.0	265	Very hard	Granular	Creamy yellow.	2.37	.86	1.43	6.50	.437	10.86	10.13	2.97	5.54	8.51	34.90	3.03
14188	62.3	1.9	10.0	71.0	69.6	273	Soft	Soft	Slightly creamy.	1.51	.41	1.82	6.50	.328	10.05	9.01	2.77	4.91	7.68	36.07	2.44

TABLE 87.—*Wheats grown in Poland: Baking properties of the variety samples described in Tables 85 and 86*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of load	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14189	127	50	51.6	1,940	484	74	71	Poor	Creamy, gray	Brown	No break	279
14187	146	52	58.8	1,650	505	82	90	Fair	Very creamy	do	Fair	192
14188	124	64	53.6	1,840	491	84	90	Good	Light creamy	Pale	do	283

RUSSIA (UNION OF SOCIALIST SOVIET REPUBLICS)

Before the World War, Russia led the world in both acreage and production of wheat, but owing to the low yield per acre (average 10 bushels) Russia's lead in production was slight. During the early post-war period, Russian wheat production suffered a catastrophic decline, but since 1925 it has reached, and in some years exceeded, the pre-war level. During the period 1925–1928, Asiatic Russia accounted for approximately 40 per cent of the Russian wheat produced.

Three prime factors unite to enforce the location of the wheat belt in the south and southeast of Russia. They are climate, soil, and location with regard to shipping ports.

Severe winter temperatures in north and central Russia make winter wheat production hazardous. As a result, the great winter wheat region is in the south and southeast of European Russia and is comprised largely of the areas of the Ukraine and North Caucasus. In Asiatic Russia, winter wheat is grown in Transcaucasia and Turkestan (Russian central Asia.)

Spring wheat is an important crop in the south and southeast areas, but the areas of production extend further northward both in Europe and Asia. The most important parts are the middle and lower Volga, in Bashkir-Orenburg, North Caucasus, Ukraine, and Ural region, which lie partly in Europe and partly in Asia, and Siberia and Kazak-Kirghiz, and to a lesser extent in Transcaucasia and Turkestan.

RUSSIAN VARIETIES

Through the assistance of A. Kol, chief of the bureau of plant introduction, Institute of Applied Botany, located at Leningrad, Soviet Russia, samples of 40 varieties of wheat, representative of the wheat now commercially important in Russia, were received. The names of the varieties and the location at which they were grown are given in Table 88.

All varieties except the durum were of the *vulgare* species of wheat. Classified according to the United States standards for wheat 5 of these varieties were hard red spring wheats, 11 were hard red winter wheats, 9 were soft red winter wheats, 13 were durum wheats, and 2 were white wheats.

The protein content of the Russian varieties was outstanding. In every instance the percentage of protein was very high.

All of these varieties were graded, milled, and baked in the same manner as in the other tests. The results are given in Tables 88, 89, and 90.

TABLE 88.—*Wheats grown in Russia: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
[1] 14057	Bezenchouk Experiment Station, Samara.	Beloturka No. 79–III	Durum	1 Amber Durum	0.0	99.2	63.0	3.9	0.1	0.0
[1] 14061	do	Sivouska No. 3	do	do	.0	99.5	62.9	3.7	.0	.0
14050	Burmensk Experiment Station, Moscow.	Atriceps	Hard red winter	2 Dark Hard Winter	.3	88.4	59.3	3.0	2.2	.2
14235	Ejsk. Experiment Station	Local Spring	Durum	3 Mixed (durum, 86.5 per cent; hard red spring, 13.5 per cent).	.0		57.2	2.7	.8	.0
14741	Rostov-Nahichevan	Ukrainka	Hard red winter	1 Dark Hard Winter	.3	96.8	61.2	3.3	1.2	.0
14745	do	Cooperatorka	do	do	.3	82.1	61.8	3.2	.1	.0
14746	do	Kostianum 0237	do	do	.4	92.9	61.3	2.9	.2	.0
14744	do	Durable	do	2 Hard Winter	.1	72.2	59.2	2.8	2.0	.1
14207	Timirjazev	Selection 2460	Soft red winter	2 Red Winter	.3		60.9	3.2	3.9	.0
14736	Donetz Agricultural Experiment Station.	Caesium 0III	Hard red spring	1 Northern Spring	.0	73.2	61.6	2.4	1.2	.0
14738	do	Hordeiforme 010	Durum	1 Amber Durum	.3	86.1	60.6	3.2	.3	.1
14739	do	Melanopus 069	do	do	.3	81.2	61.6	3.2	.8	.1
14740	do	Hordeiforme 0189	do	do	.4	80.6	61.2	3.1	.5	.0
14737	do	Lutescens 062	Soft red winter	1 Red Winter	.6		59.2	2.4	.1	.0
14747	do	Albidium 0604	White	2 Mixed (white, 85.2 per cent; hard red spring, 14.8 per cent).	.4		58.7	2.3	.6	.0
14052	Ekaterinoslav Agricultural Experiment Station.	Ghirka 071	Hard red spring	1 Hard Spring	.0	96.7	61.0	2.2	.1	.0
14046	do	Uljka 058	do	4 Dark Northern Spring	.0	81.9	54.3	2.0	.2	.2
[1] 14054	do	Garnovka Krasnokolosaja 05.	Durum	1 Amber Durum	.0	99.4	61.3	3.6	.0	.0
14056	do	Garnovka barkhatistaja	do	2 Amber Durum	.0	99.0	58.3	2.4	.5	.0
14055	do	Garnovka belokolosja 051	do	3 Amber Durum	.0	98.0	57.6	2.5	.3	.0
14048	do	Krasnaja ostistaja	Soft red winter	2 Red Winter	.0		58.0	2.9	1.2	.0
14047	do	Krasnaja besostaja 046	do	3 Red Winter	.0		56.0	2.3	.0	.0
14051	do	do	do	do	.0		57.7	2.2	.4	.0
14234	Kharkov Experiment Station.	Krasnaja ostistaja	do	1 Red Winter	.0		60.0	3.5	2.0	.0
14045	Mironovsk	Ukrainka 246	Hard red winter	1 Dark Hard Winter	.0	98.6	61.2	4.1	.8	.0
14743	Nemerchausk	Durable	do	4 Dark Hard Winter	.0	81.4	55.5	2.6	2.5	.0
14742	do	Ukrainka	do	2 Hard Winter	.0	73.0	59.1	3.4	3.4	.0
14206	Odessa Agricultural Experiment Station.	Vl'ka 00604	Hard red spring	3 Dark Northern Spring	.0	94.6	56.8	2.6	.2	.0
14205	do	Ghirka 00620	do	4 Dark Northern Spring	.9	84.4	53.1	1.6	.4	.2
14202	do	Arnautka 00614	Durum	2 Amber Durum	.0	99.8	58.3	2.7	.1	.0

14204	do	Arnautka 00620	do	do	.0	98.8	59.2	2.5	2.0	.0
14203	do	Chernouska 001222	do	do	.0	98.7	58.5	2.7	1.0	.0
14201	do	Chernouska 00630	do	4 Amber Durum	.0	93.7	59.8	2.9	10.0	.1
13993	do	Cooperatorka 0914	Hard red winter	1 Dark Hard Winter	.0	97.3	62.0	3.3	.2	.0
13994	do	Stepniatchka 0496	do	do	.0	99.9	63.8	3.2	.0	.0
13995	do	Zemka 0158	do	do	.0	99.0	61.5	3.6	.4	.0
14208	do	Selection 2470	White	1 Soft White	.2	64.5	60.5	3.7	.8	.0
14236	Poltava Experiment Station.	Poltavka helokolosaja	Soft red winter	1 Red Winter	.0		60.3	3.1	1.3	.1
14049	Verkhniatechsk Experiment Station, Kiev.	Donki 13[1]2/102	do	2 Red Winter	.2		58.1	3.9	.1	.0
14053	do	Nepoliagaiustchaja 0351	do	5 Red Winter	.2		53.4	3.2	3.8	.0

[1] Crop of 1925.

TABLE 89.—*Wheats grown in Russia: Milling properties of the variety samples described in Table 88, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14057	62.0	3.1	9.3	73.3	71.0	263	Very hard	Granular	Creamy	1.45	0.91	1.85	6.57	0.315	16.29	15.85	5.76	7.86	13.63	42.26	2.85
14061	62.4	3.4	9.2	71.7	69.3	269	Soft	Soft	White	1.17	.89	1.81	6.52	.357	16.04	15.34	5.40	7.87	13.27	40.69	3.10
14050	60.5	3.1	9.0	65.3	63.5	293	Semihard	do	do	1.75	.69	2.06	6.73	.209	16.36	15.55	5.49	7.92	13.41	40.94	2.22
14235	57.8	2.5	10.4	69.4	67.7	279	Very hard	Granular	Very creamy	2.21	.69	1.58	6.50	.369	12.01	11.19	3.80	5.74	9.54	39.83	2.90
14741	62.8	1.5	12.4	75.0	73.8	262	do	do	White	1.20	.56	1.14	6.58	.192	12.62	11.70	4.41	5.49	9.90	44.54	2.40
14745	63.3	1.2	12.3	74.3	73.4	263	Hard	do	do	1.01	.48	1.24	6.56	.207	11.37	10.41	3.72	5.21	8.93	41.66	2.78
14746	63.1	1.8	12.2	73.6	72.2	267	do	do	Creamy	2.26	.49	1.21	6.66	.186	11.12	10.31	3.90	4.85	8.75	44.57	1.93
14744	60.6	1.5	11.9	73.8	72.7	265	do	do	do	1.70	.56	1.39	6.46	.222	11.32	10.65	3.58	5.38	8.96	39.96	2.57
14207	62.9	1.8	10.4	68.2	67.0	282	Very soft	Soft	do	1.85	.42	1.46	6.58	.228	11.21	10.30	3.46	5.32	8.78	39.41	1.97
14736	62.3	1.4	12.0	73.4	72.4	266	Hard	Granular	Slightly creamy	1.29	.56	1.56	6.51	.248	13.31	12.24	4.72	5.86	10.58	44.61	2.20
14738	60.3	2.3	12.1	74.2	72.5	266	do	do	Creamy	1.78	.79	1.41	6.49	.312	14.22	13.60	4.83	6.69	11.52	41.93	2.96
14739	61.6	2.0	12.2	72.4	70.1	275	do	do	Slightly creamy	1.51	.79	1.40	6.49	.274	12.67	12.50	4.60	6.07	10.67	43.11	2.38
14740	61.4	2.2	12.1	74.2	72.6	266	do	do	do	1.41	.73	1.34	6.61	.232	12.67	12.33	4.69	5.76	10.45	44.88	2.76
14737	60.7	2.5	11.7	70.0	68.2	282	Soft	Soft	do	1.30	.59	1.48	6.59	.226	12.77	11.56	4.64	5.18	9.82	47.25	1.83
14747	60.1	2.4	11.9	73.3	71.6	269	Hard	Granular	White	1.19	.65	1.53	6.58	.247	12.06	11.10	4.45	4.81	9.26	48.06	2.02
14052	60.4	1.8	10.2	68.3	67.1	281	Soft	Soft	Creamy	1.92	.57	1.72	6.72	.241	12.74	11.50	4.21	5.36	9.57	43.99	1.76
14046	56.0	2.6	9.8	65.7	64.0	294	Hard	Granular	Slightly creamy	1.34	.58	1.90	6.66	.286	15.06	13.60	5.31	5.82	11.13	47.71	2.29
14054	61.3	2.3	10.5	72.2	70.5	269	do	do	do	1.64	.70	1.56	6.50	.275	15.15	14.52	5.33	7.18	12.51	42.61	3.14
14056	58.4	2.6	10.1	72.4	70.5	267	do	do	Very creamy	2.94	.90	1.82	6.63	.217	14.05	13.60	5.31	5.82	11.13	47.71	2.29
14055	57.7	3.2	9.8	71.6	69.3	271	do	do	do	2.81	.91	1.84	6.61	.278	14.74	14.26	5.36	6.65	12.01	44.63	2.52
14048	59.4	2.5	9.8	70.0	68.3	275	Tough	Soft	Creamy	2.20	.49	1.69	6.63	.244	13.80	12.46	4.63	5.86	10.49	44.14	2.20
14047	57.1	2.5	9.8	69.5	67.8	277	Soft	do	do	2.21	.49	1.73	6.66	.259	13.78	12.43	4.80	6.71	11.51	41.70	1.01
14051	58.7	2.3	9.7	70.5	68.9	273	do	do	do	2.17	.46	1.65	6.62	.182	13.74	12.16	5.68	5.64	10.32	45.35	2.31
14234	61.0	2.5	10.4	70.9	69.1	274	Semihard	do	White	1.00	.47	1.49	6.45	.295	13.87	12.73	4.26	6.57	10.83	39.34	1.98
14045	61.7	1.9	10.7	75.8	74.3	256	Hard	Granular	Slightly creamy	1.44	.55	1.68	6.55	.233	13.21	12.67	4.35	6.23	10.58	41.12	1.63
14743	57.0	1.9	12.2	72.9	71.5	270	Very hard	do	Creamy	1.64	.54	1.63	6.44	.342	13.41	12.50	4.40	6.25	10.65	41.31	1.84
14742	60.6	1.6	12.6	75.7	74.5	260	Hard	do	White	.76	.56	1.48	6.47	.302	12.73	11.79	4.27	5.82	10.09	42.32	2.18
14206	59.0	2.2	10.0	68.0	66.5	283	Soft	Soft	do	1.23	.66	1.89	6.47	.347	18.78	18.05	6.38	9.45	15.83	40.30	1.93
14205	55.9	3.3	10.2	65.9	64.3	294	do	Very soft	Slightly creamy	1.81	.46	2.03	6.52	.347	12.68	12.03	3.92	6.46	10.38	37.76	2.03
14202	58.9	2.8	10.2	68.6	66.7	283	Hard	Soft	do	1.51	.79	1.73	6.58	.309	19.45	18.95	6.51	10.03	16.56	39.31	3.73
14204	59.7	2.7	10.0	70.8	68.9	273	Very hard	Granular	Creamy	1.56	.74	1.61	6.45	.328	17.98	17.60	7.28	8.05	15.33	47.49	2.92
14203	59.2	3.3	10.0	69.2	66.9	282	Hard	do	do	1.73	.74	1.60	6.66	.272	16.94	16.12	5.21	8.86	14.07	37.03	3.38

14201	60.7	2.9	10.3	60.3	67.3	281	----do----	----do----	Slightly creamy---	1.39	.76	1.54	6.49	.285	16.40	15.84	5.44	8.37	13.81	39.39	3.69
13993	63.6	1.3	10.4	72.9	71.9	203	----do----	----do----	----do----	1.24	.46	1.45	6.65	.193	12.46	11.95	3.70	6.96	10.66	34.71	2.26
13994	64.5	1.4	10.4	76.4	75.3	251	----do----	----do----	----do----	1.54	.53	1.48	6.62	.193	14.58	14.12	5.17	6.98	12.15	42.55	2.22
13995	62.6	1.5	10.5	73.0	71.9	263	----do----	----do----	Creamy----	2.50	.40	1.49	6.67	.193	13.78	13.09	4.27	7.10	11.37	37.56	2.20
14208	61.7	1.8	10.8	74.9	73.6	258	Soft----	Very soft----	----do----	1.86	.46	1.80	6.45	.468	9.21	8.60	2.85	4.24	7.09	40.20	2.24
14236	61.5	2.3	10.5	69.8	68.2	278	Semihard---	Soft----	Slightly creamy---	1.36	.50	1.70	6.53	.421	10.49	9.56	3.49	4.44	7.93	44.01	2.04
14049	59.2	2.4	10.0	71.0	69.4	271	Soft----	----do----	Creamy----	2.45	.50	1.71	6.42	.245	10.96	10.07	3.52	4.88	8.40	41.92	2.42
14053	53.3	2.7	10.4	70.3	68.4	277	----do----	Very soft----	----do----	2.63	.45	1.89	6.55	.275	11.34	10.39	3.53	5.23	8.76	40.41	1.84

TABLE 90.—*Wheats grown in Russia: Baking properties of the variety samples described in Tables 88 and 89*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14057	136	55	60.8	2,130	520	85	94	Excellent	Creamy	Brown	Good	300
14001	144	60	66.6	2,170	526	82	92	do	do	do	Poor	303
14050	104	51	52.7	1,920	490	68	23	Very poor, crumbly	Creamy, gray	do	Fair	282
14235	140	68	59.1	2,040	517	84	88	Good	Very creamy	do	do	298
14741	145	60	61.2	2,130	505	84	90	do	Creamy, gray	do	do	291
14745	156	77	59.5	2,090	504	87	86	Fair	Light creamy	do	do	291
14746	156	66	56.0	1,840	498	81	80	Poor	Very creamy	do	Poor	287
14744	155	61	56.6	1,780	498	83	52	Very poor, crumbly	Creamy, gray	do	Very poor	287
14207	112	68	55.0	2,000	499	83	82	Good	Very creamy	Light brown	Fair	288
								SAMPLES FROM UKRAÏNE				
14736	140	63	65.0	2,410	511	85	91	Good	Creamy	Light brown	Fair	295
14738	142	64	60.7	1,850	507	76	72	Poor	Very creamy	Brown	Very poor	292
14739	154	71	69.3	1,990	531	80	93	Excellent	do	Foxy brown	do	306
14740	145	67	61.4	2,000	511	80	86	Good	do	do	do	295
14737	124	64	56.8	2,160	498	83	86	Fair	Creamy, gray	Light brown	Fair	287
14747	134	59	59.0	2,090	503	82	88	do	Creamy	Brown	do	290
14052	104	51	52.4	1,730	500	70	14	Very poor, crumbly	Creamy, gray	Light brown	Poor	288
14046	132	61	54.1	2,060	499	78	64	Fair, crumbly	Very creamy, gray	do	Fair	288
14054	130	61	62.2	2,130	528	83	93	Excellent	Creamy, gray	do	do	304
14056	137	60	59.4	2,050	516	77	90	Good	Very creamy	Brown	do	297
14055	132	59	60.1	2,100	520	78	88	do	do	do	do	300
14048	109	55	53.6	1,920	497	75	48	Poor, crumbly	do	do	Poor	287
14047	107	55	51.3	1,950	490	75	56	do	do	Light brown	do	282
14051	104	59	50.6	2,110	495	82	78	do	Creamy	do	Fair	285
14234	109	61	53.7	2,520	482	88	92	Good	do	Brown	Excellent	278
14045	143	57	56.3	1,990	503	78	58	Fair, crumbly	Very creamy	Light brown	Poor	290
14743	159	60	55.5	2,010	492	77	52	Very poor, crumbly	do	Foxy brown	Fair	284
14742	145	59	61.1	2,250	508	88	91	Good, crumbly	Light creamy, gray	Brown	do	293
14206	130	61	54.9	2,480	489	84	93	Good	Creamy	Light brown	Excellent	282
14205	133	63	56.3	2,150	498	82	81	Fair	do	do	Fair	287
14202	145	58	65.0	2,430	518	78	88	Excellent	Very creamy	Brown	Poor	299
14204	138	55	63.8	2,470	509	80	93	do	do	do	Fair	293
14203	140	62	61.5	2,190	508	76	88	do	do	do	Poor	293
14201	141	64	68.0	2,300	527	79	88	do	do	do	do	304
13993	140	63	58.3	1,910	503	87	86	Fair, crumbly	Creamy	do	Fair	290
13994	144	59	59.1	1,940	507	85	58	Poor, crumbly	do	do	Poor	292
13995	112	50	58.0	1,730	504	78	42	Very poor, crumbly	Very creamy	do	do	291
14208	119	67	53.8	2,120	493	84	88	Good	Creamy	Pale	Fair	284
14233	116	64	54.4	1,990	499	87	90	Fair	do	Light brown	do	288
14049	109	47	57.6	1,670	506	74	38	Very poor	Very creamy	do	Poor	291
14053	97	47	53.2	1,730	498	72	18	Very poor, crumbly	Creamy, gray	do	do	287

It is apparent that the hard red winter wheats had the best milling quality among the five classes of Russian wheats tested, as it required, on an average, approximately 265 pounds of wheat to produce a barrel of flour. Next in order of merit were the durum wheats, followed by the soft red winter wheats and the hard red spring wheats. The samples of white wheats were not sufficiently large to make it safe to draw conclusions.

Baking strength of the flour milled from the durum wheats was, individually and collectively, excellent. This is evidenced by the high water absorption of the flour, the long fermentation time of the dough, the large size of the loaf, and the high scores for grain and texture of the crumb of the loaf. High bread yields were also associated with the durum wheat flours.

The baking data associated with the hard red winter wheat flours show that these flours were lacking in strength. Whereas volume of loaf averaged fairly high, the other factors indicative of good strength, such as a good grain and texture of the crumb, were, in a number of instances, very poor. Six out of the eleven hard red wheat varieties tested were noticeably deficient in baking strength.

The poorest baking quality of all was associated with the soft red winter wheat flours. Four of the nine varieties tested produced flour that baked into bread of very poor quality. The fermentation time of the soft wheat doughs averaged considerably shorter than is usual with soft red winter wheat doughs.

The baking strength of only two of the hard red spring wheat flours was sufficiently high to call them of good quality. Of the other three varieties, the baking strength of two was very poor and that of the third variety was somewhat below average.

The baking qualities of the two white wheat varieties were above the average for this class of wheat.

If a comparison is made of the baking quality of these Russian varieties and those of similar classes grown in North America, it is apparent that only the Russian durum wheat varieties had as great baking strength as those varieties grown in North America. The Russian spring and winter wheats, in spite of their very high protein content, displayed weakness in baking strength too frequently to be called the equals of North American wheats. The Russian white wheats appeared to have very good baking quality.

RUSSIAN EXPORT WHEATS

No export shipments of Russian grain were available for this study. However, a general suggestion regarding their quality is made by Kent-Jones (5, *p.* 37), who says:

> Before the war, Russian wheats were plentifully used by English millers, but since 1914 they have been scarce. A number of consignments have arrived this year [1926], however, and they appear to maintain their pre-war features. They are fairly glutinous, containing 10.5 to 13.5 per cent protein, although the gluten is of a flowy nature. They lack stability. They usually weight 58 to 62 pounds (imperial) to the bushel. Rye is the important impurity, and unless removed before milling, tends to accentuate the lack of stability. The north Russian wheats shipped from Baltic ports generally have a higher moisture content and yield flour of less stability than south Russian wheats.

The results obtained from the tests here reported emphasize the lack of stability in Russian wheats.

SCOTLAND

The annual production of wheat in Scotland is about 2,000,000 bushels. Common wheat (*Triticum vulgare*), of winter habit is grown exclusively. Many of the varieties found in England and Ireland are grown in Scotland. A comparison of the milling and baking qualities of some of the principal commercial varieties grown in Scotland was made possible through the courtesy of Charles Wetherill, Secretary of the Board of Agriculture for Scotland. Samples of three varieties of red winter wheat—Standard Red, Swedish Iron, and Squareheads Master—and of three varieties of white wheat—Yeoman, Victor, and Benefactor—were received. The following information accompanied these samples.

Standard Red is the most important red winter wheat variety grown in Scotland. It is cultivated chiefly in the counties of Fife, Forfar, and Perth. It is well represented throughout the wheat-growing areas, more especially in the districts where a large production of straw is desired and where the climate is not entirely suitable for wheat growing. It is high yielding and gives a relatively good quality of grain for grinding. It is resistant to excessive rain and does not lodge easily, which makes it adaptable to rich soils. It is, however, sensitive to rust.

Swedish Iron is a red winter variety of very high-yielding properties for both grain and straw, and is likewise grown chiefly in the counties of Fife, Forfar, and Perth. It has a tendency to ripen late and is more or less confined to early districts. It is somewhat sensitive to the adversities of winter; when the autumn is favorable to a good start, so that the wheat becomes well rooted before winter, a better result is obtained.

Squareheads Master is grown extensively in the southwest of Scotland, comprising about one-half of the acreage under wheat in that district.

Yeoman is a white winter variety of comparatively recent introduction. It has a high reputation for milling purposes, but as a rule it is a poor straw producer (poorer than most other varieties now cultivated), and is not as universally grown as Standard Red. It is produced chiefly in the counties of Westlothian, Midlothian, and Eastlothian.

The white variety Victor is universally grown in wheat-producing sections, chiefly in the Lothians, and may be said to be of first importance in the class it represents. It gives good yield of both grain and straw.

Benefactor, another white winter wheat, is not extensively grown and is chiefly confined to the central district of Scotland.

The production of Standard Red, Swedish Iron, Squareheads Master, and Victory, is steady, whereas the production of Yeomen is increasing, and the production of Benefactor is decreasing.

Standard Red is used largely for mixing with other wheats for milling purposes; the product from the other varieties is used extensively for the making of pastry and biscuit flours, or poultry and stock feeds.

The results of the milling and baking tests of the samples of the six varieties of Scotch wheats are shown in Tables 91, 92, and 93.

TABLE 91.—*Wheats grown in Scotland: Description and characteristics of the variety samples*

Laboratory No.	County where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14170	Midlothian	Yeoman	Soft red winter	1 Red Winter	0.2		60.2	3.9	1.5	0.0
14171	do	Standard Red	do	3 Red Winter	.3		57.8	4.3	4.9	.2
14169	do	Swedish Iron	do	do	.1		57.7	4.5	4.2	.0
14172	Ayrshire	Squareheads Master	do	Sample Red Winter	.2		60.1	4.9	15.6	.0
14173	Midlothian	Victor	White	2 Soft White	.3	4.0	59.1	4.4	3.6	.0
14174	Stirlingshire	Benefactor	do	5 Soft White	.0	20.3	60.1	4.6	10.4	.0

TABLE 92.—*Wheats grown in Scotland: Milling properties of the variety samples described in Table 91, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14170	61.3	1.5	11.6	75.5	74.5	257	Soft	Very soft	Slightly creamy	1.02	0.55	1.76	6.48	0.466	9.12	8.15	3.05	3.44	6.49	47.00	2.26
14171	59.5	2.2	9.1	70.5	69.2	270	do	do	White	1.05	.63	1.70	6.47	.375	8.68	7.61	2.80	3.22	6.02	46.51	2.32
14169	58.7	2.0	9.7	66.7	66.7	282	do	Soft	Very white	.90	.52	1.69	6.54	.361	7.54	6.25	2.28	2.47	4.75	48.00	2.53
14172	61.6	2.6	9.5	69.3	67.6	277	do	Very soft	White	1.00	.58	1.66	6.48	.394	9.13	7.61	2.82	3.22	6.04	46.69	2.22
14173	60.5	1.9	9.4	71.4	70.3	266	do	Soft	do	1.24	.58	1.60	6.55	.333	7.73	7.11	2.35	3.20	5.55	42.35	2.36
14174	61.7	2.0	9.4	74.4	72.9	257	do	Very soft	do	1.36	.56	1.67	6.42	.385	9.02	8.73	2.73	4.42	7.15	38.18	2.30

TABLE 93.—*Wheats grown in Scotland: Baking properties of the variety samples described in Tables 91 and 92*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14170	101	50	53.9	1,610	499	80	59	Fair, crumbly	Creamy, gray	Light brown	Poor	288
14171	96	46	53.3	1,530	490	54	56	do	Very creamy, gray		do	282
14169	108	50	53.3	1,540	499	80	56	Very poor	Light creamy, gray	Pale	do	288
14172	92	44	53.1	1,580	500	53	59	Fair, crumbly	Very creamy, gray	Light brown	do	288
14173	94	41	52.7	1,550	496	78	62	do	Creamy	Pale	do	286
14174	93	39	52.0	1,500	492	72	54	Poor, crumbly	Very creamy	Light brown	do	284

Under the United States standards for wheat the varieties Standard Red, Swedish Iron, and Squareheads Master would be classified as soft red winter wheat, and the varieties Victor and Benefactor would be classified as white wheat. A considerable percentage of damaged wheat was present in all the varieties with the exception of Yeoman, which accounts to a great extent for the numerical grades assigned to each variety.

From a milling standpoint, all the varieties were of excellent quality, producing high yields of flour typical in texture for the class of wheat which they represent. According to the samples, none of the wheats are of high protein content; consequently the protein in the resulting flour is correspondingly low.

Judged as to baking strength, the quality of all the resulting Scotch flours was weak. Fermentation time was very short, averaging less than 100 minutes, whereas the usual time for soft red winter and white wheat flour ranges from 115 to 130 minutes. The water absorption of the flour was similarly low. As was the experience with the flours milled from English and Irish wheats, the resulting bread was small in volume and coarse in texture, as well as of poor color. The delicate brown crust usually associated with the bread from strong flour was absent in every instance.

From a milling standpoint, that is, their ability to produce a large quantity of flour, Scotch wheats compare very favorably with those grown in other parts of the world. However, the flour lacks strength and can not by itself be made into an acceptable loaf of bread. Mixing with strong wheats imported from overseas would be very helpful in improving the baking quality of Scotch wheats.

SPAIN AND PORTUGAL

Wheat production in Spain and Portugal is influenced to a large extent by the climate and relief of the country. On the northern coast and along much of the Atlantic coast excessive rains during the growing period are detrimental. In the southern and eastern coastal areas drought and hot winds frequently reduce yields, and frost and limited rainfall are adverse factors in the interior plateau areas. To the west and north, between the humid coastal area and the interior plateau, there is an intermediate section where either drought or excessive rains may be damaging factors.

Winter wheats of the *vulgare* species predominate in the humid and intermediate areas, while wheats of the poulard and durum classes are more commonly grown than the other classes in the warm dry Mediterranean territory of the south and east. Spring wheats form only a small percentage of the total wheat acreage and are grown mostly in the northern coastal area and in some mountainous interior sections.

The introduction of modern milling machinery has made it possible to utilize much harder wheats for flour than was possible when stone mills exclusively were used; consequently efforts are being made to obtain wheats of stronger quality that can withstand the prevailing climatic conditions of the different sections. The North American wheat varieties Marquis, Kota, and Kanred, are now receiving attention.

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Production of wheat in Spain has averaged 137,000,000 bushels annually for the last 20 years. Spain usually exports small quantities of wheat, but difficulties of cultivation and transportation from the interior prevent it from becoming a very important export country.

Production of wheat in Portugal is more variable, fluctuating between 6,000,000 and 12,000,000 bushels annually since 1924.

The varieties of wheat of commercial importance in Spain, according to Don Ricardo de Escauriaza, director, Granja Agricola de Valladolid, Estacion de Ensayo de Semillas, who furnished samples, are as follows:

Candeal de la Sagra is a variety of white wheat of winter habit. It represents 96 per cent of the white wheat cultivated in the Provinces of Madrid, Toledo, Guadalajara, Segovia, Avila, Soria, Salamanca, and Caceres.

Candeal Fino is also a variety of white wheat of winter habit. It represents 90 per cent of the white wheat grown in the Provinces of Ciudad Real, Albacete, Cuenca, and Murcia.

Red Candeal is a red winter wheat representing 75 per cent of the red winter wheat cultivated in the Provinces of Valladolid, Zamore, Palencia, Soria, and Segovia.

Red wheat of Burgos, a red winter wheat, represents all the late winter wheat cultivated in the Province of Burgos, and 25 per cent of that grown in Palencia.

The variety Recio represents 90 per cent of the hard winter wheat, durum, cultivated in the Provinces of Granada, Malaga, Almeria, and Jaen.

The Candeal varieties are used in bread making, and the Duro, or hard wheats, are used in the manufacture of vermicelli and in mixtures.

From the Minister of Agriculture of Portugal, samples of three varieties of wheat of commercial value were secured, namely Temporao de Coruche, Nacional, and Mourisco.

Temporao de Coruche is of winter habit and is the type of milling wheat most suitable to the northern areas of the country. However, it is cultivated with success in almost any part of the country. It is a rust-resistant variety.

The variety Nacional is of winter habit and is characteristic of the wheat grown in the central parts of the country. It is a poulard wheat.

The type of hard wheat characteristic of the central and southern parts of the country is the durum variety Mourisco.

The results of milling and baking tests made upon the five varieties of Spanish wheat are given in Tables 94, 95, and 96; and the results of similar tests made upon the varieties obtained from Portugal are shown in Tables 97, 98, and 99.

TABLE 94.—*Wheats grown in Spain: Description and characteristics of the variety samples*

Laboratory No.	Province where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13985	Granada	Recio	Durum	1 Amber Durum	0	86.2	61.5	5.4	0.0	0.0
13986	Burgos	Red wheat of Burgos	Soft red winter	2 red winter	0		58.2	4.8	.4	.0
13987	Valladolid	Red Candeal	do	1 Mixed (soft red winter, 87.6 per cent; white 12.4 per cent).	0		61.3	4.6	.6	.1
13989	Toledo	Candeal de la Sagra	White	1 Soft White	0	43.8	62.2	4.6	.5	.0
13988	Ciudad Real	Candeal Fino	do	1 Mixed (white, 80.7 per cent; soft red winter, 19.3 per cent).	0		60.9	4.2	.5	.0

TABLE 95.—*Wheats grown in Spain: Milling properties of the variety samples described in Table 94, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*			*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13985	61.8	2.8	9.9	71.2	69.2	272	Very hard	Granular	Creamy yellow	2.66	0.99	1.83	6.54	0.208	10.80	10.49	3.46	5.30	8.76	39.50	2.78
13986	59.3	2.5	9.7	70.8	69.0	272	Soft	Very soft	do	2.23	.57	1.82	6.61	.249	9.87	9.03	3.62	3.97	7.59	47.69	2.13
13987	62.6	2.2	9.6	72.6	71.0	264	do	do	Creamy	2.07	.49	1.53	6.61	.311	8.45	7.54	2.75	3.22	5.97	46.06	2.42
13989	63.0	1.7	9.9	73.4	72.1	261	do	Soft	do	2.14	.50	1.51	6.62	.288	8.59	7.76	2.82	3.48	6.30	44.76	2.44
13988	62.4	2.5	9.8	73.2	71.4	263	do	do	Creamy yellow	2.54	.49	1.35	6.71	.168	10.79	10.30	3.82	4.97	8.79	43.46	2.90

TABLE 96.—*Wheats grown in Spain: Baking properties of the variety samples described in Tables 94 and 95*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13985	130	52	68.6	1,380	543	78	31	Poor	Very creamy	Brown	No break	313
13986	96	51	53.3	1,780	491	86	72	Fair, crumbly	Creamy	Light brown	Poor	283
13987	100	57	52.2	1,750	490	82	68	Poor, crumbly	Very creamy	do	do	282
13989	103	52	52.5	1,740	492	70	42	Very poor	Creamy, gray	do	do	284
13988	107	51	52.5	1,720	494	79	42	Poor, crumbly	Very creamy	Brown	do	285

TABLE 97.—*Wheats grown in Portugal: Description and characteristics of the variety samples*

Laboratory No.	Region where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14190	South central	Mourisco	Durum	1 Amber Durum	0	94.1	60.6	5.6	1.3	0.0
14192	Northern	Temporão de Coruche	Soft red winter	1 Red Winter	0		61.8	3.9	.7	.2
14191	Central	Nacional	White poulard		0	14.4	57.0	4.6	.0	.0

TABLE 98.—*Wheats grown in Portugal: Milling properties of the variety samples described in Table 97, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*			*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14190	60.7	4.0	9.2	69.5	66.7	280	Very hard	Granular	Creamy	1.64	0.77	1.93	6.54	0.356	9.68	9.09	2.73	4.76	7.49	35.35	2.46
14192	63.1	2.9	8.9	69.0	66.1	281	Semihard	Soft	White	.87	.57	1.91	6.48	.399	9.56	8.87	2.81	4.65	7.46	37.67	2.83
14191	56.7	4.4	9.2	68.1	65.1	287	do	Granular	Creamy	1.62	.63	1.93	6.54	.366	8.44	7.36	2.26	3.19	5.45	36.45	3.13

TABLE 99.—*Wheats grown in Portugal: Baking properties of the variety samples described in Tables 97 and 98*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14190	146	55	63.7	1,470	524	80	72	Very poor	Creamy, gray	Brown	No break	302
14192	115	60	50.9	1,840	480	86	86	Good	Light creamy	Light brown	Fair	277
14191	149	67	51.9	1,650	494	87	88	Poor	do	Pale	do	285

The wheats of Spain, those recognized as bread-making varieties, although of excellent milling quality are of decidedly inferior baking quality as the flour lacks that highly desirable attribute known as strength. This lack of strength is reflected in the low water absorption of the flour, in the fermentation tolerance of the dough, and in the small size and coarse texture of the resulting loaf of bread. All five bread-making varieties milled into flour that produced a small loaf of bread of coarse texture and poor color.

The durum variety Recio was similarly of little account as a bread-making wheat, as it also lacked strength. Flour milled from the wheats of Spain should not be used for purposes that require a large expansion of the gluten. They will find a more useful outlet in such products as biscuits, cakes, or crackers, where gluten quality is not so important.

Of the Portuguese varieties tested, the soft winter wheat variety Temporão de Coruche, was the only variety that appeared to be a fair bread wheat; flour milled from it baked into a passably good loaf of bread. However, the milling qualities of this wheat are somewhat lacking, as a low flour yield was experienced from a wheat of somewhat above average test weight.

The durum variety Mourisco, in addition to being below average in milling quality, was decidedly inferior in bread-making qualities. This is also true of the milling and baking properties of the samples of poulard wheat studied.

SWEDEN

Acreage devoted to wheat in Sweden has increased about 40 per cent since the World War. This has resulted in an increase in production of some 6,000,000 bushels of wheat annually. In 1924–25 the importation of wheat amounted to approximately 11,500,000 bushels. In 1926–27 and 1927–28 the importation was 8,484,000 and 10,391,000 bushels, respectively. Sweden exports some wheat. In 1927–28 1,660,000 bushels were exported, as compared with 107,000 bushels in 1924–25 and 639,000 bushels in 1925–26.

In Sweden only red wheats, of both winter and spring habit, of the vulgare type are grown. Club wheats and durum wheats are not grown.

Among the prominent winter wheat varieties are Iron, Crown, Earl, Standard, Sun II, Thule II, Swedish II, and Lant. All varieties of Swedish winter wheats are soft wheats. It is claimed that the varieties Thule and Lant are somewhat the stronger.

Extra-Kolben I and II, Ruby, Diamond, Aurora, and Fiskeby, are representative varieties of spring wheat. All the spring varieties are decidedly hard in texture, with the exception of Extra-Kolben I and II, which are reported as being somewhat softer.

Samples of three of the Swedish red winter wheat varieties—Iron, Sun II, and Thule II—and of three of the spring wheat varieties—Kolben, Extra-Kolben II, and Ruby,—were obtained from A. Akerman, of the department of wheat and oat breeding, at Svalof, Sweden. In submitting these varieties Professor Akerman wrote that the variety Thule had the best baking quality of the three red winter wheats submitted. It is grown most extensively in the district of Lake

Malaren. Of the other two varieties, Sun II is claimed to be of better baking quality than Iron. The variety Sun II is grown more widely than any other variety in the Läns of Oster and Vastergotland. Iron wheat is grown rather extensively in the Län of Skane. As a matter of interest the variety Trifolium 14, a white winter wheat, was also sent. It is bred in Denmark from the Dutch variety Wilhelmina. It is not now cultivated in Sweden.

The spring variety Kolben is said to resemble the variety Red Fife in its baking qualities. Sometime ago it was the earliest maturing spring wheat variety in Sweden. It is gradually being replaced by Extra-Kolben II, a cross between Kolben and the German variety Emma. Extra-Kolben II produces considerably better wheat than Kolben, and is the preferred variety of southern Sweden. Even earlier in maturity than either Kolben or Extra-Kolben II is the variety Ruby. It is grown further north than are the other two varieties.

Samples of all of these seven varieties were graded, milled, and baked in the same manner as were other world wheat varieties. The results of these tests are given in Tables 100, 101, and 102.

TABLE 100.—*Wheats grown in Sweden: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14584	Agricultural experiment station, Svalof.	Kolben	Hard red spring	1 Northern Spring	0.0	52.2	61.2	3.2	0.2	0
14586	do	Extra-Kolben II	do	1 Red Spring	.2	13.2	61.9	3.4	1.4	0
14585	do	Ruby	do	2 Red Spring	.2	22.4	60.9	3.5	2.8	0
14588	do	Sun II	Soft red winter	2 Red Winter	.0		58.4	4.5	1.6	0
14589	do	Iron	do	3 Red Winter	.0		57.3	3.7	.6	0
14587	do	Thule II	do	5 Red Winter	.2		59.7	3.7	11.3	0
14590	do	Trifolium 14	White	3 Soft White	.0	19.7	56.3	4.0	1.5	0

TABLE 101.—*Wheats grown in Sweden: Milling properties of the variety samples described in Table 100, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yields—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14584	62.3	0.8	11.5	73.5	72.9	263	Hard	Granular	White	1.32	0.56	1.97	6.55	0.441	10.29	9.36	3.10	4.90	8.00	38.75	2.22
14586	63.0	1.1	12.9	73.0	72.2	270	do	do	do	1.39	.49	1.98	6.56	.401	8.74	7.68	2.43	4.20	6.63	36.65	2.38
14585	61.0	1.5	11.6	72.4	71.4	269	do	do	Slightly creamy	1.77	.60	2.05	6.60	.405	9.13	7.96	2.79	3.89	6.68	41.77	2.17
14588	58.9	1.8	12.8	70.8	69.5	280	Soft	Soft	do	1.68	.47	1.78	6.53	.408	9.64	8.36	2.76	4.46	7.22	38.23	2.34
14589	58.7	1.2	12.7	69.7	68.9	282	do	Very soft	White	1.39	.47	1.76	6.53	.438	9.77	8.82	2.78	4.80	7.58	36.68	2.13
14587	60.7	1.3	12.5	69.9	69.0	275	do	do	Creamy	1.76	.57	1.82	6.55	.391	10.64	9.76	3.49	4.62	8.11	43.03	2.08
14590	57.0	1.9	12.4	70.5	69.2	280	do	Soft	White	1.28	.49	2.07	6.58	.409	8.32	6.89	2.28	3.47	5.75	39.65	2.91

TABLE 102.—*Wheats grown in Sweden: Baking properties of the variety samples described in Tables 100 and 101*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14584	158	66	59.3	1,880	500	86	88	Fair, crumbly	Light creamy	Light brown	Poor	288
14586	149	77	58.3	1,770	503	81	81	Poor	Very creamy	Pale	do	290
14585	153	65	55.5	1,740	494	80	82	Very poor, crumbly	do	Light brown	Very poor	285
14588	115	67	53.4	1,730	487	70	74	do	do	Pale	Poor	281
14589	120	63	53.4	1,730	488	74	70	do	do	do	do	281
14587	114	47	54.2	1,580	490	76	68	do	Creamy, gray	Light brown	Very poor	282
14590	118	58	52.4	1,620	482	72	70	do	Very creamy	Pale	do	278

The milling and baking tests of the three varieties of spring wheat showed that this class of Swedish wheat is much superior in milling and baking qualities than that of the winter wheat varieties. Of the three spring wheat varieties, the variety Kolben ranked first with Extra-Kolben II and Ruby next in order.

From a milling standpoint, the variety Thule II ranked first among the red winter wheats. Considered from a baking standpoint, however, Thule II ranked third because of lack of baking strength. Flour from this variety baked into a very small loaf of poor color and texture.

The loaf volume of the bread made from the other two varieties of red winter wheat—Sun II and Iron—was approximately the same as that made from wheats of the same class grown in continental Europe. The baking qualities of all Swedish varieties tested is much lower than that of similar wheats grown in America or in southwestern Europe.

SWEDISH EXPORT WHEATS

Samples from two export cargoes shipped from Sweden to Bremen were secured through the Superintendence Co. These samples were milled and baked as usual.

Each cargo, the one of spring wheat and the other of soft red winter wheat, was slightly below the average milling and baking quality of export wheats of similar classes shipped from Argentina, Canada, or the United States. The loaves were small and coarse in texture, most decidedly so in the case of the cargo of soft red winter wheat.

As a result of the analysis of the Swedish varieties and export wheat, it is apparent that wheats grown in this country, although of good-to-average milling quality, are somewhat weak so far as baking quality is concerned and need to be supplemented with strong imported wheats to enhance their baking qualities.

SWITZERLAND

Switzerland raises between 3,500,000 and 4,000,000 bushels of wheat annually. It imports about 75 per cent of its wheat requirement. In 1927–28 imports amounted to 18,427,000 bushels.

Relief, soil, and climate have had much to do with limiting the wheat acreage of Switzerland. The plateau east of the Jura mountain range is better adapted to wheat growing than are other sections because it is not so subject to excess rain. In other sections the heavy rains of summer frequently result in lodging of the grain and epidemics of rust and smut.

As regards climatic phenomena with relation to wheat production, the country can be divided into two zones, a wet and a cold and wet zone. The wet zone comprises a large part of the Cantons of Thurgau, Aargau, St. Gallen, and parts of Graubrunden (Grisons). Excessive rains and diseases are the chief drawbacks to wheat growing in this area. The cold and wet zone comprises the remainder of Switzerland. There the excessive rains and winter adversities are equally harmful to wheat growing.

Freezes in winter and the prolonged cover of snow are detrimental to wheat growing in parts of the country. In other parts that are little protected by snow, alternate freezing and thawing in late winter are harmful.

The most important wheat-producing Cantons are Vaud, followed by Bern, Fritbourg, Zurich, Aargau, and Geneva, in the order of their importance.

About 95 per cent of the wheat grown in Switzerland is winter wheat. Spring wheat is not extensively grown. Some of the more common Swiss varieties are Monte Calme 22, Plantahof, Venogé Rouge, Vaumarcus, Wagenburger, Rheinauer, and Carré Vaudois. The first four were submitted as red winter wheats, the fifth as a spring wheat, and the last two as white winter wheats of the club type. Monte Calme 22 is grown in western and northern Switzerland and is said to be a good milling wheat. Plantahof is similar in nature to Monte Calme 22 and is grown extensively in central, northern, and eastern Switzerland. Rheinauer is grown extensively in eastern Switzerland, but its popularity is declining, as the general tendency is to check the growth of white and club wheats. Although described as a white winter wheat it was classed and graded by us as a red winter wheat due to the color of the kernels. Upon examination of the sample of the variety Carré Vaudois, it was classified as a red club wheat and was, therefore, graded as western red wheat. It is extensively cultivated in western Switzerland. The varieties Venogé Rouge, Vaumarcus, and Wagenburger are still in the introductory stage. Venogé Rouge is of winter habit, and is well adapted to the conditions prevalent in northern and western Switzerland. Vaumarcus is also of winter habit. Wagenburger, on the other hand, is a spring wheat of Manitoba selection, and the acreage devoted to it is small.

Samples of these seven varieties were obtained through the courtesy of the Administration Federale des Blés at Berne, Switzerland, and their relative milling and baking qualities were determined. Results of these tests are given in Tables 103, 104, and 105.

On an average, the milling quality of all the varieties tested was good. Test weight per bushel was good to average and the yield of flour was high. The protein content of the wheat was only average.

From a baking standpoint all flours exhibited weaknesses. This was more pronounced in the winter-wheat varieties. Only one variety of winter wheat evidenced an ability to make a large loaf of bread of fair texture and grain. This was the variety Plantahof. Next in baking strength was the flour milled from the spring-wheat variety Wagenburger. All of the other varieties produced flour noticeably weak in this respect.

Swiss wheats, therefore, are in line with most of the wheats cultivated in continental Europe. Although of good milling quality, the majority are decidedly lacking in baking strength. Their baking quality should be strengthened by blending with strong wheats from overseas. Otherwise, they are more suited to the manufacture of biscuits, crackers, etc., in which gluten strength is of less importance.

TABLE 103.—*Wheats grown in Switzerland: Description and characteristics of the variety samples*

Laboratory No.	Canton where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14029	Basle	Wagenburger	Hard red spring	1 Dark Northern Spring	0	82.8	59.1	3.7	2.0	0.0
14023	Vaud	Mont Calme 22	Soft red winter	1 Red Winter	0		61.3	3.6	1.4	.0
14026	Basle	Venogé Rouge	do	do	0		60.6	3.7	.4	.1
14027	Neuchatel	Vaumarcus	do	do	0		61.7	4.1	.1	.0
14028	Basle	do	do	do	0		61.6	4.7	.2	.0
14021	Soleure	Mont Calme 22	do	2 Red Winter	0		58.7	3.5	2.6	.0
14025	Basle	Plantahof	do	do	0		59.3	3.6	1.2	.1
14031	Rheinau	Rheinquer	do	3 Red Winter	0		59.6	4.2	4.4	.0
14030	Vaud	Carré Vaudois	do	1 Western Red	0		60.3	3.8	.0	.0

TABLE 104.—*Wheats grown in Switzerland: Milling properties of the variety samples described in Table 103, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14029	60.8	1.9	9.5	70.9	69.5	269	Soft	Soft	White	0.91	0.60	1.79	6.32	0.480	12.65	11.87	4.17	5.80	9.97	41.83	1.76
14023	62.9	1.5	10.2	71.0	69.9	270	do	do	do	1.11	.48	1.69	6.42	.328	10.93	10.24	3.38	5.22	8.60	39.31	1.79
14026	62.3	1.6	9.8	70.0	68.9	273	do	do	do	1.32	.60	1.77	6.64	.336	9.88	9.24	3.38	4.13	7.51	45.01	2.51
14027	62.4	2.1	9.5	72.0	70.4	266	do	do	Slightly creamy	1.65	.52	1.66	6.55	.306	9.98	9.60	3.23	4.87	8.10	39.88	2.22
14028	62.1	1.7	12.1	72.5	71.3	271	do	do	do	1.55	.54	1.75	6.49	.346	11.65	11.22	3.96	5.40	9.30	42.58	2.00
14024	60.7	1.5	11.7	70.6	69.5	276	do	do	Creamy	2.21	.43	1.67	6.45	.297	11.22	9.80	3.16	4.86	8.02	39.40	2.07
14025	60.9	1.5	12.2	74.3	71.7	269	Hard	Granular	White	1.33	.64	1.80	6.45	.426	11.82	11.12	3.41	6.12	9.53	35.78	2.05
14031	60.4	2.2	10.3	73.0	71.4	265	Soft	Soft	Creamy	2.00	.53	1.74	6.46	.357	10.01	8.94	3.02	4.34	7.36	41.03	1.89
14030	61.6	1.2	9.0	70.1	69.2	269	do	do	do	1.95	.45	1.63	6.42	.214	8.70	8.06	2.62	3.99	6.61	39.65	2.09

TABLE 105.—*Wheats grown in Switzerland: Baking properties of the variety samples described in Tables 103 and 104*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14029	110	56	55.8	1,890	503	80	66	Fair, crumbly	Creamy	Brown	Poor	290
14023	108	45	54.0	1,570	502	79	36	Poor, crumbly	Very creamy	Light brown	do	289
14026	103	50	56.3	1,580	506	74	17	Very poor, crumbly	Creamy, gray	do	No break	291
14027	106	52	53.2	1,580	496	75	26	Poor, crumbly	Very creamy	Brown	Poor	286
14028	103	52	54.6	1,730	501	78	38	do	Creamy	do	do	289
14024	108	47	54.2	1,710	501	80	40	do	Very creamy	Light brown	do	289
14025	102	50	60.5	1,840	520	76	79	Fair, crumbly	Creamy	Brown	do	291
14031	106	46	53.5	1,670	494	73	34	Poor	Very creamy	Light brown	do	285
14030	108	48	51.0	1,560	491	76	36	do	do	Pale	do	283

MILLING AND BAKING QUALITIES OF WHEATS GROWN IN AFRICA

Morocco, Algeria, Tunis, and Egypt represent the countries producing wheat in northern Africa. In 1928 the estimated production was over 104,000,000 bushels. The character of the wheat grown in these areas, with a discussion of their relative milling and baking quality, is given in the following pages.

EGYPT

Cultivation of wheat in Egypt is concentrated in the delta zones and along the banks of the Nile as far as the vicinity of Assouan. An extended acreage of wheat has developed on the left of the river near the marshes of Buket el Karum in the Province of Medinet el Fayum.

Cultivation of wheat is almost exclusively under irrigation, which makes drought damage a small factor. The most harmful factor is rust, which is favored under conditions in Egypt by damp weather in contrast to the usual relation with a wet, warm climate.

Sowings take place as early as possible in the fall so that harvest will be ready before the arrival of hot weather the next spring. The date of sowings is dependent upon the flooding of the rivers which carry to the desert the tropical rains and render possible the growth of crops in the sections where rainfall is rare. In Egypt this is from November to the first part of December and later.

The wheats of Egypt are reported as of two distinct types—the native Egyptian varieties (*Triticum pyramidale*) and the common wheat varieties (*T. vulgare*).

Beladi is the most prominent native variety. The kernels of this variety are either red or white in color. This variety, although rather susceptible to rust, is a strong producer and is much preferred by small farmers. Beladi 26 and 31 represent the red type of kernel. Wheat of this type represents about 95 per cent of the red native wheats grown in lower Egypt. Beladi 42, on the other hand, is a white-kerneled variety. It represents 95 per cent of the white native wheats grown in upper Egypt. Sinai 2 and Sinai 14, the former a red wheat and the latter a white wheat, are two new and promising varieties of native wheats.

Among the common-wheat varieties, Hindi wheats of Indian origin are most common. Hindi D represents about 75 per cent of the whole wheat acreage cultivated in Egypt. The kernels of this variety are white in color and of opaque character. Indian VIII B and Hindi 39 are promising varieties of common wheats with translucent kernels.

According to the director of the botanical and plant-breeding section of the Department of Agriculture located at El Giza, Egypt, Egyptian wheats can not be grouped into winter and spring habits because the temperature in Egypt is fairly high and because several winter English wheats have been tried in Egypt without success. Egyptian wheats, therefore, are to be considered as spring wheats although they are sown in the autumn.

Samples of the Egyptian varieties just described were obtained from the Department of Agriculture at El Giza, and were milled and baked in the usual manner. Resulting data are given in Tables 106, 107, and 108.

TABLE 106.—*Wheats grown in Egypt: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13671	Plant-breeding station, Giza	Indian VIII B	White	1 Hard White	0	97.9	62.4	3.2	0.1	0
13702	Plant-breeding station, Sakha, Giza, and Gemmaza.[1]	Hindi D	do	do	0	82.7	62.7	3.7	.0	0
13668	Plant-breeding station, Giza	Hindi 39	do	do	0	75.6	64.2	3.9	.0	0
13672	do	Hindi 12	do	do	0	73.2	63.0	4.0	.0	0
13670	do	Sinai 14	Red poulard	Not graded	0	.....	61.2	3.4	.0	0
13667	Plant-breeding station, Giza and Gemmaza.[2]	Beladi 26	do	do	0	.....	56.7	3.6	.0	0
13703	do [2]	Beladi 31	do	do	0	.....	60.0	3.6	.0	0
13704	do [2]	Beladi 42	White poulard	do	0	.....	58.0	4.6	3.2	1
13669	Plant-breeding station, Giza	Sinai 2	White and red poulard	do	0	52.2	61.8	4.5	.0	0

[1] Composite of same variety grown at the 3 stations listed.

[2] Composite of same variety grown at the 2 stations listed.

TABLE 107.—*Wheats grown in Egypt: Milling properties of the variety samples described in Table 106, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*Pc. t.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*			*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13671	63.6	1.7	10.2	72.5	71.3	265	Semihard	Granular	White	1.65	0.65	1.71	6.60	0.268	11.03	10.72	4.59	4.60	9.19	49.95	1.65
13702	63.4	1.2	10.9	71.7	70.8	268	Soft	Soft	do	1.44	.64	1.62	6.62	.238	7.99	7.22	2.92	2.79	5.71	51.14	3.06
13668	64.4	1.4	11.1	74.4	73.4	262	Very hard	Granular	Slightly creamy	1.94	.66	1.60	6.68	.308	8.61	7.84	2.83	3.60	6.43	44.01	3.25
13672	63.6	1.3	11.0	70.2	69.3	275	Soft	Soft	White	1.44	.62	1.57	6.70	.218	8.02	7.47	2.76	3.61	6.37	43.33	2.90
13670	61.6	2.2	11.1	65.9	64.5	296	Very hard	Granular	Creamy	1.64	.88	1.91	6.67	.308	11.37	10.68	3.98	5.12	9.10	43.74	3.62
13667	57.4	4.0	11.5	68.2	65.4	293	Hard	do	Slightly creamy	1.57	.54	1.47	6.60	.191	8.85	7.32	2.94	2.88	5.82	50.52	3.77
13703	60.6	2.3	11.0	70.9	70.1	272	Very hard	do	do	1.46	.80	1.59	6.53	.267	8.62	7.94	3.59	3.34	6.93	51.80	3.71
13704	58.7	2.4	11.2	72.4	70.8	270	Hard	do	Very slightly creamy.	1.04	.68	1.60	6.37	.302	9.11	7.87	2.97	3.06	6.07	48.93	3.48
13669	62.2	2.7	10.8	69.4	67.5	281	do	do	Creamy	1.85	.78	1.68	6.62	.326	9.71	8.81	2.79	4.62	7.41	36.30	3.35

TABLE 108.—*Wheats grown in Egypt: Baking properties of the variety samples described in Tables 106 and 107*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13671	103	57	62.6	1,680	520	89	79	Fair	Creamy	Light brown	Poor	300
13702	115	61	52.3	1,610	491	78	58	Poor, crumbly	do	Pale	do	283
13668	127	58	60.5	1,550	517	82	59	Poor	Very creamy	Light brown	do	298
13672	108	56	55.6	1,640	501	85	51	Poor, crumbly	Creamy	Pale	do	289
13670	121	55	62.0	1,110	523	72	6	Very poor	Very, very creamy	Light brown	No break	301
13667	102	55	57.5	1,180	504	74	5	do	Very creamy, gray	Pale	do	291
13703	130	48	58.1	1,260	508	66	16	do	Very creamy	do	do	293
13704	123	42	56.5	1,160	505	69	12	do	do	do	do	291
13669	124	55	61.8	1,160	520	76	7	do	do	Light brown	do	300

All the native wheats were found to be varieties of poulard wheat. The varieties of common wheat, on the other hand, would classify as white wheats in the United States.

From almost every standpoint the native wheats of Egypt were of lesser milling and baking quality than the common (vulgare) wheat varieties. Good bread could not be made, as the flour milled from native wheats was practically devoid of strength. The common wheats, however, were of good milling quality, and although their flours lacked strength the bread made from them was as good, in most cases, as bread made from flours milled from wheat raised in continental Europe. On the other hand, the baking qualities of the flours milled from the common wheats was not nearly so good as that milled from wheats of similar classes grown in North America, India, or Australia.

MOROCCO

Wheat production is expanding in Morocco. According to the Yearbook of Agriculture of the United States Department of Agriculture, the estimated production in 1928 was 24,746,000 bushels. Yields are higher than in Tunis and Algeria. The soil is especially rich on the plains of Chacuia, and the water supply is more regular than for the other countries in north Africa because of the favorable Atlantic exposure. Hard wheats, mostly of the durum species, comprise about 90 per cent of the wheat grown in Morocco. The production of soft wheats is expanding.

Of the varieties grown, the durum variety Dredria, and the soft white variety Vilmorin are the most in demand.

M. Miege, director of the station for the selection and study of seeds, Rabat, Morocco, kindly furnished samples of these varieties for milling and baking tests. Results of these tests are given in Tables 109, 110, and 111.

TABLE 109.—*Wheats grown in Morocco: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13659	Seed selection station, Rabat	Dredria	Durum	1 Durum	0	71.2	63.4	5.1	1.2	0
13660	do	Vilmorin	White	1 Mixed, (white, 81.9 per cent; soft red winter, 18.1 per cent).	0		61.9	3.8	.5	0

TABLE 110.—*Wheats grown in Morocco: Milling properties of the variety samples described in Table 109, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten prot. in flour	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13659	63.0	2.4	12.1	71.4	69.7	277	Very hard	Granular	Very creamy	1.53	0.81	1.83	6.43	0.422	12.38	11.82	4.12	6.00	10.12	40.71	2.65
13660	62.6	1.2	12.2	71.0	70.1	275	Soft	Soft	White	1.33	.60	1.80	6.49	.337	12.50	12.05	4.50	6.04	10.54	42.70	1.93

TABLE 111.—*Wheats grown in Morocco: Baking properties of the variety samples described in Tables 109 and 110*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13659	142	55	65.6	1,560	526	83	80	Fair	Creamy	Brown	Poor	363
13660	117	47	55.8	1,790	507	83	82	do	Creamy, gray	do	Fair	292

The varieties demonstrated equally good milling properties, but both were deficient in baking qualities. This is especially true of the durum variety, in which the lack of gluten quality was marked. Fair baking strength was shown by the soft wheat variety, but it showed noticeable weakness, as evidenced by the coarse texture of the loaf. The color of the crumb was below average in the bread made from the soft wheat flour.

The milling and baking quality of the durum variety was characteristic of that of the durum wheats of Greece and Tunis. The milling and baking quality of the soft winter wheat compares very favorably with similar wheats grown in Tunis, Egypt, and South Africa.

TUNIS

Cultivation of wheat in Tunis is determined partly by the nature of the soil but chiefly by the distribution of rainfall. Wheat and barley occupy about 90 per cent of the sown area. On the plains of Tunis and Grombalia, and on the high plateaus of Kef and Maktar, the two cereals are cultivated in about equal areas. In southern Tunis wheat is not extensively grown.

Drought and hot winds are undoubtedly the most harmful weather factors. Drought in the spring is the most harmful in its effects. Insufficiency of rains during the autumn can be overcome by sufficient rains the following winter, and a drought during winter can be compensated for by rains in autumn and spring. The wet years are always the best. Rust is another damaging factor to wheat production in Tunis.

For several years only the hard wheats (durums) were cultivated but recently Europeans have introduced soft wheats, and the natives are beginning to cultivate them.

The yield of white wheats is much greater than that of the hard wheats. Acreage devoted to white wheats in 1927 was 143,000 acres.

Red winter wheats are not extensively cultivated nor are the club varieties of the white wheats. On account of the period of vegetation some wheats are to be considered as of winter habit and others of spring habit. Among the white wheat varieties that could be considered as winter grown are Blé de Mahon 124 and Barleta 53. Prominent white wheats, which could be classified as of spring habit, are Richelle native 110, Florence 135, and Irakie 231. The first three white wheats are extensively grown. The last two are under trial, but their use is increasing because of their high productivity.

Among the hard wheats (durums) the three varieties most commonly grown are Mahmoudi ap 4, Biskri ac 10, and Hamira ac 5. These three varieties are the best known and the most appreciated, and they form the basis of the mixture sown by the natives.

The native wheats are so mixed that it is not possible to give any prominent variety name, and the history of an average sample would be illusory.

In Tunis, at the Jardin Botanique, a breeding station is maintained for the development of pure seed wheat. Through the courtesy of M. F. Boeuf, chief of the botanical service, lots of seed wheat were obtained, representing the seven varieties discussed above.

The usual milling and baking tests were made to determine baking value. Results are given in Tables 112, 113, and 114.

TABLE 112.—*Wheats grown in Tunis: Description and characteristics of the variety samples*

Laboratory No.	Locality where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13863	Arina, Tunisa	Biskri ae 10	Durum	1 Amber Durum	0.0	96.4	62.9	4.5	0.0	0.0
13852	do	Hamira ae 5	do	do	.0	99.0	61.4	4.3	.0	.0
13864	do	Mahmoudi ap 4	do	do	.0	85.5	61.4	5.6	.7	.0
13865	do	Blé de Mahon 124	White	1 Hard White	.0	97.6	60.6	3.9	.4	.0
13868	do	Irakie 231	do	do	.0	97.7	60.9	3.3	.1	.0
13869	do	Florence 135	do	3 Hard White	.0	92.8	58.9	3.3	6.0	.2
13867	do	Barletta 53	do	1 Soft White	.2	74.5	61.5	4.3	1.2	.0
13866	do	Richelle native 110	do	do	.1	67.0	60.4	3.4	.5	.0

TABLE 113.—*Wheats grown in Tunis: Milling properties of the variety samples described in Table 112, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield— Basis cleaned and scoured wheat	Flour yield— Basis dockage-free wheat	Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour: Visual	Color of flour: Gasoline value	Ash in flour	Ash in wheat	Acidity of wheat as— pH	Acidity of wheat as— Lactic acid	Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13863	63.4	2.3	11.3	72.2	70.5	271	Very hard	Granular	Slightly creamy	1.69	0.83	1.68	6.37	0.387	10.66	9.81	3.33	4.72	8.05	41.37	3.04
13862	62.3	2.1	10.8	71.6	70.1	271	do	do	Creamy	3.21	.91	1.89	6.47	.423	10.98	10.22	3.77	4.37	8.14	46.31	3.17
13864	62.2	3.1	11.3	72.6	70.4	272	do	do	Slightly creamy	1.20	.81	1.64	6.50	.347	10.66	10.07	3.65	4.56	8.21	44.46	3.18
13865	62.0	2.6	11.0	71.3	69.4	275	Semihard	Soft	White	1.33	.49	1.73	6.60	.317	11.39	10.64	3.68	5.18	8.86	41.53	1.94
13868	61.8	1.8	10.7	73.4	72.1	263	Very hard	Granular	do	1.49	.53	1.49	6.72	.231	12.96	12.44	4.43	6.12	10.55	41.99	2.64
13869	60.8	3.2	10.8	74.3	72.0	264	Hard	do	do	1.07	.45	1.49	6.69	.312	12.45	11.63	4.11	5.65	9.76	42.11	2.26
13867	62.9	2.4	11.0	72.2	70.5	270	Semihard	Soft	do	1.52	.43	1.66	6.58	.328	10.32	9.63	3.14	4.90	8.34	37.65	1.52
13866	61.9	2.0	10.8	70.7	69.3	274	Soft	do	do	1.35	.60	1.51	6.65	.327	9.82	8.83	3.21	3.82	7.69	41.76	2.27

TABLE 114.—*Wheats grown in Tunis: Baking properties of the variety samples described in Tables 112 and 113*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13863	120	52	63.2	1,460	532	82	20	Poor	Creamy	Brown	Poor	306
13862	114	45	61.6	1,320	521	76	8	Very poor	Very, very creamy	do	No break	300
13864	129	55	64.8	1,400	538	84	39	Good	Very creamy	do	Poor	310
13865	108	56	51.4	1,650	492	86	36	Poor, crumbly	Creamy	do	do	284
13868	118	58	58.0	1,820	508	89	90	Good	do	do	Fair	293
13869	94	49	58.1	1,830	511	87	51	Poor, crumbly	do	do	Poor	295
13867	110	60	51.8	1,930	490	88	91	Good, crumbly	do	do	do	282
13866	113	56	53.5	1,740	493	86	89	Fair	Very creamy	do	do	284

The milling value of all the varieties examined was good, and a high yield of flour of ordinary protein content resulted from each milling. The flour milled from all of the durum varieties, however, was very weak as regards baking strength. Loaves of bread made from the durum wheat flour had an average loaf volume of 1,393 cubic centimeters, as compared with over 2,000 cubic centimeters for the bread baked from flours milled from North American or Russian durum wheats. Crumb texture was noticeably poor.

Several of the white-wheat varieties, showed fairly good baking strength. Outstanding is the variety Barleta 53, from which flour of good baking strength was obtained, but the baking strength of its companion wheat, as regards winter habit, Blé de Mahon 124, was not nearly so good. The white wheats of spring habit—the varieties Irakie 231, Richelle native 110, and Florence 135—produced flour of fair strength, in the order named.

It would appear, therefore, that there is good reason for the substitution of soft winter varieties for the hard (durum) varieties in Tunis. Compared with the white wheats of continental Europe, the white wheats of Tunis are above the average. Nevertheless, milled by themselves they are more properly adapted to biscuit and cracker manufacture than to the production of high-quality bread. Blending with strong wheat would be beneficial to their baking performance.

UNION OF SOUTH AFRICA

Wheat is grown in the most southern part of Africa, the Union of South Africa.

According to the Yearbook of Agriculture of the United States Department of Agriculture for 1928, the production of wheat in the Union of South Africa is now above the pre-war average. In 1927 production amounted to 6,644,000 bushels. Production satisfies about 60 to 70 per cent of the requirements of the Union. Usually, large quantities of both wheat and flour are imported from Australia, Argentina, and Canada. In 1927, 8,212,000 bushels of wheat were imported, approximately 2,600,000 bushels less than the average imported in 1924–25 to 1926–27.

Although wheat is grown more or less in every Province of the Union the varied climatic conditions which prevail in the Union (dissimilar even within the area of each Province) have a marked influence upon the growth of wheat.

The Cape Province produces, on the average, about 75 to 80 per cent of the wheat crop of the Union. This production is confined to a comparatively small area in the southeastern portion of the Cape, for it is only in this area that winter rains occur with degree of regularity to warrant wheat production on a large scale. Part of the remainder of the Union is largely semiarid; and in the summer-rainfall area the climatic conditions, in general, are not suited to the production of wheat.

In Transvaal, a small but stable quantity (75,000 bushels) of wheat is produced annually under irrigation. In the Orange Free State normal production is approximately 100,000 bushels but crop failures sometimes occur in this Province.

As is the case in Australia and India, the wheats of the Union of South Africa are to be classed as early, mid-season, and late. In the Cape Province winter wheats are largely grown. Sowing takes place

from April to June and harvesting in November and December. In the irrigated areas and in areas of summer rains a wheat of considerably shorter maturity is desirable, so that the spring types of wheats are preferred.

The wheat trade in the Union of South Africa is usually based on a "f. a. q." (fair average quality) basis. The f. a. q. basis in use in South Africa differs from the Australian f. a. q. in that it is not a fixed standard established by the Government or by any board, but is merely what the trade considers to be a "fair average quality" of the season's crop. Thus there is likely to be considerable fluctuation from year to year in what constitutes f. a. q.; it differs from Province to Province and from district to district. There are usually 3 f. a. q. grades—1 for the western Cape Province, which is the main producing area; 1 for the Orange Free State; and 1 for the Transvaal.

Thirteen samples of wheats from the Union of South Africa carrying the trade designations just cited were obtained from the department of agriculture at Pretoria, South Africa, through the courtesy of W. O. Stahl, senior research officer. The grade of each sample, with the notation as to whether the sample represented a variety or a mixture of several varieties, and the area of production follows:

(1) Malmesbury f. a. q., mixed, ex Western Province area.
(2) Western Province f. a. q., mixed, ex Western Province area.
(3) Malmesbury f. a. q., white, ex Western Province area.
(4) Western Province f. a. q., white, ex Western Province area.
(5) Transvaal Red, variety Red Egyptian, ex Potchefstroom area, Transvaal Province.
(6) Transvaal f. a. q., white, variety Gluyas Early, Potchefstroom area, Transvaal Province.
(7) Transvaal f. a. q., red, variety Red Klein Koring, Potchefstroom area, Transvaal Province.
(8) Transvaal f. a. q., white, Lydenburg area, Transvaal Province.
(9) Transvaal f. a. q., red, Lydenburg area, Transvaal Province.
(10) Transvaal f. a. q., mixed, Lydenburg area, Transvaal Province.
(11) Transvaal f. a. q., red, Middelburg area, Transvaal Province.
(12) Orangia f. a. q., white, Bethlehem area, Orange Free State Province.
(13) Orangia f. a. q., red.

As usual, these wheats were subjected to the grading, milling, and baking tests previously described. Resulting data are shown in Tables 115, 116, and 117.

TABLE 115.—*Wheats grown in the Union of South Africa: Description and characteristics of the variety samples*

Laboratory No.	Province where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14793	Orange Free State	Orangia f. a. q. (red)	Soft red winter	1 Red Winter	0.0		61.1	3.3	1.5	0.2
14798	do	Orangia f. a. q. (white)	White	1 Hard White	.4	86.6	61.3	3.7	1.2	.0
14792	Transvaal	Transvaal f. a. q. (red)	Hard red spring	1 Dark Northern Spring	.0	75.5	63.9	3.7	.1	.0
14790	do	do.[1]	do	do	.5	82.2	65.0	3.4	.8	.0
14789	do	do.[2]	do	1 Northern Spring	.2	67.5	61.2	2.6	.8	.0
14791	do	do	do	do	1.2	61.0	60.2	2.8	.5	.3
14795	do	Transvaal f. a. q. (mixed)	do	1 Mixed (hard red spring 54.8 per cent, white 45.2 per cent).	1.9		61.2	3.2	.1	.2
14797	do	Transvaal f. a. q. (white)[3]	White	1 Hard White	1.0	78.6	61.9	3.9	1.2	.0
14796	do	do	do	1 Mixed (white 83.2 per cent, hard red spring 16.8 per cent).	1.8		61.8	3.9	.0	.1
14788	Western Province	Malmesbury f. a. q. (mixed)	Soft red winter	2 Red Winter	.8		62.7	4.6	.0	.6
14794	do	Western Province f. a. q. (mixed)	do	1 Mixed (soft red winter 59.2 per cent, white 40.8 per cent).	.3		62.2	4.5	.1	.9
14799	do	Malmesbury f. a. q. (white)	White	1 Hard White	.3	99.5	63.7	4.0	.0	.0
14800	do	Western Province f. a. q. (white).	do	do	.6	91.8	61.8	4.0	.1	.0

[1] Variety Red Klein Koring.

[2] Variety Red Egyptian.

[3] Variety Gluyas Early.

TABLE 116.—*Wheats grown in the Union of South Africa: Milling properties of the variety samples described in Table 115, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and sour-ings removed	Moisture of wheat before tempering	Flour yield		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14793	62.0	1.0	11.9	70.8	70.1	275	Soft	Soft	Slightly creamy	1.72	0.49	1.70	6.50	0.310	8.94	7.76	2.67	3.81	6.48	41.20	2.15
14798	62.5	1.7	12.0	73.4	72.4	266	Semihard	do	White	1.38	.60	1.51	6.42	.368	11.66	10.99	3.99	5.51	9.50	42.00	2.20
14792	64.5	.7	11.4	69.9	69.4	276	Hard	Granular	do	1.09	.50	1.50	6.44	.305	10.52	10.05	3.15	5.54	8.69	36.25	2.78
14790	65.5	1.4	11.8	72.9	72.3	266	Very hard	do	do	1.16	.50	1.35	6.46	.206	11.14	10.25	3.26	5.51	8.77	37.17	2.64
14789	62.7	1.0	11.4	70.4	69.8	274	Soft	Soft	do	1.42	.57	1.49	6.47	.269	12.07	10.63	3.35	5.43	8.78	38.15	2.36
14791	61.7	3.3	11.4	68.3	66.8	286	Semihard	do	do	1.28	.62	1.58	6.50	.290	9.95	9.42	3.06	4.82	7.88	38.83	2.30
14795	62.3	3.8	11.3	70.1	68.7	278	Soft	Very soft	do	1.21	.56	1.48	6.46	.290	11.56	10.96	3.81	5.66	9.47	40.23	2.67
14797	63.0	2.7	11.1	73.1	71.9	265	Semihard	Soft	do	1.43	.55	1.86	6.49	.465	10.08	9.55	3.47	4.72	8.19	42.37	2.07
14796	62.5	3.4	11.4	71.7	70.6	271	Soft	Very soft	do	1.09	.49	1.42	6.44	.290	13.05	12.00	4.26	6.20	10.46	51.67	2.34
14788	63.6	2.9	11.7	71.1	69.6	276	do	Soft	do	1.02	.54	1.65	6.43	.331	9.32	8.76	2.99	4.36	7.35	40.68	2.81
14794	63.0	2.8	11.0	70.7	69.6	274	do	Very soft	do	1.09	.52	1.66	6.54	.351	10.97	10.32	3.52	5.25	8.77	40.14	2.12
14799	63.8	2.0	11.5	73.6	72.3	265	Hard	Granular	do	1.23	.50	1.26	6.47	.270	10.21	9.80	3.28	5.16	8.44	38.86	2.87
14800	62.5	1.9	11.7	71.8	70.9	271	Soft	Soft	do	1.24	.50	1.58	6.51	.369	9.66	8.83	2.91	4.56	7.47	38.96	2.48

TABLE 117.—*Wheats grown in the Union of South Africa: Baking properties of the variety samples described in Tables 115 and 116*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14793	143	79	56.9	1,830	499	80	84	Poor, crumbly	Very creamy	Pale	Very poor	288
14798	140	62	58.3	1,900	496	78	70	Very poor, crumbly	Very creamy, gray	Brown	do	286
14792	153	76	57.6	1,700	527	84	81	Poor, crumbly	Creamy	do	do	304
14790	145	73	57.4	1,870	522	82	82	do	do	Light brown	Poor	301
14789	131	49	59.5	1,860	502	80	76	Very poor, crumbly	Very creamy	do	Very poor	289
14791	124	67	63.0	1,820	515	76	82	Poor, crumbly	Creamy, dark gray	do	Poor	297
14795	130	71	60.1	1,890	503	83	84	do	Creamy, gray	Brown	Very poor	290
14797	156	53	54.9	1,600	498	71	78	Very poor, crumbly	Creamy, very dark gray	Light brown	do	287
14796	158	65	61.4	1,960	510	88	88	Fair	Creamy	Brown	Fair	294
14788	146	59	56.7	1,680	496	63	78	Very poor, crumbly	do	Light brown	Very poor	286
14794	133	63	55.2	1,800	496	82	80	Poor, crumbly	do	Brown	do	286
14799	126	61	65.2	1,786	523	86	76	Poor	do	do	do	301
14800	125	66	59.4	1,810	502	84	78	do	Very creamy	do	do	289

On the basis of their kernel characteristics, the wheats grown in the Orange Free State were classified as red and white winter wheats. On the other hand, the wheats grown in Transvaal were, in the main, typically hard red spring wheats. Western Province wheats were large white wheats of winter characteristics.

The milling quality of the wheats from each Province was excellent, as a large quantity of flour of medium ash content and good color was obtained in almost every instance. Compared as to Province, the wheats grown in the Western Province had slightly better milling quality than those grown in either Orange Free State or in Transvaal. With regard to the milling quality of the several classes of wheat produced in the Union, the white wheats were somewhat similar to the spring wheats and the red winter wheats.

From a baking standpoint, the flour milled from the wheat grown in each Province, as well as the flour milled from each class of wheat, was not greatly different. On the basis of averages, the flour milled from the hard red spring wheats was slightly stronger. Compared with wheats of the same classes grown in North America and Russia, the baking strength of all classes of South African wheats is noticeably low. It would be decidedly helpful if they could be blended with strong wheat from America to improve their baking qualities.

MILLING AND BAKING QUALITIES OF ASIATIC WHEATS

Studies were made of the milling and baking qualities of wheat grown in the following Asiatic countries: India, Iraq, Japan, and Palestine. Results of these tests are described in the following pages.

INDIA

Wheat ranks high among the cereal crops of India. It is exceeded in importance only by rice and the grain sorghums. The area devoted to wheat in India, 26,000,000 to 35,000,000 acres, has not increased perceptibly during the last 20 years. Production has fluctuated between 250,000,000 and 382,000,000 bushels annually. In British India nearly 40 per cent of the wheat area is irrigated. In the Punjab, about one-half of the wheat-sown area is irrigated.

Three-fourths of the total crop of India is produced in the North-West Frontier Province and the Central Provinces. The importance of wheat in northwestern India is the result of a combination of lower rainfall and greater extremes of temperature than are found in the more humid and tropical eastern and southern portions of India.

Climate is the most important factor regulating the production of wheat in India. The best crops are obtained in years when the late monsoon rains are ample and well distributed, and when good rains occur during the first half of the "cold-weather" season. Wet and cloudy weather when the crop is in the head, and hot winds before harvest, usually lower the yield. A heavy reduction in yield always accompanies a deficiency in summer rainfall.

INDIAN VARIETIES

To compare the milling and baking properties of the wheats grown in India with those grown in other parts of the world, samples of a number of varieties, typical of Indian wheats found in commerce, were obtained from various sources.

From the Central Provinces samples of six varieties were secured through the kindness of W. Youngman, economic botanist to the Government. These varieties were Bansi, Howrah, Kathia, Mundi, Red Pissi, and White Pissi. All of these wheats were fall sown in the "cold-weather" season.

Bansi is a hard wheat (durum) grown generally over the Central Provinces. Howrah is a durum variety grown on the plains of the Central Provinces. Kathia would be classified as a poulard wheat in the United States. White Pissi is a white variety, and is the most commonly grown wheat in the Central Provinces. Mundi is a white wheat. Red Pissi classifies as a hard red winter wheat.

Samples of four varieties were obtained from the North-West Frontier Province through the courtesy of W. Robertson Brown, agricultural officer in charge: Federation, Marquis, Pusa No. 4, and Pusa 80.5.

The variety Federation originated in Australia and is grown as a popular spring variety, occupying over 25,000 acres of the irrigated wheat area of the North-West Frontier Province.

Pusa No. 4 is a very early spring wheat grown under irrigation, occupying about 300,000 acres of irrigated land in the North-West Frontier Province. This variety is held in high repute throughout this Province.

Pusa 80.5 is as yet in the introductory stage and promises to be a serious rival of Pusa No. 4. The North American variety Marquis is also in the introductory stage. The tested lot of this variety came from the first harvest after arrival in India in 1926.

Finally, through the courtesy of Ram Dhan Singh, cerealist to the Punjab Government, samples of a number of additional varieties were received. Ten of these represented the variety Punjab No. 8, two the variety Punjab No. 11, four the variety Punjab No. 14, and one the variety Punjab No. 17. These wheats were grown throughout the Province of Punjab and with the exception of the varieties obtained from Gurdaspur (samples 15294, 15297, and 15311) and in the Rawal Pindi district (samples 15293 and 15296) they were grown in dry places of deficient rainfall and having a deep water table, where, for successful wheat growing, irrigation is essential.

All of the Punjab wheats are amber or white wheats except Punjab No. 14, which is red-kerneled. All the varieties were developed through selection by the agricultural department of Punjab. Punjab No. 11 occupied more than a million acres two or three years ago, since that time its cultivation has been declining, and it is gradually being replaced by Punjab No. 8 A. The variety Punjab No. 8 A occupied more than a million acres in 1926, and the acreage is rapidly increasing. Punjab No. 14 is a well-known wheat in those sections that depend on rain for growth, as contrasted with irrigated land. No estimate of the acreage sown to varieties Punjab No. 14, Punjab No. 8 B, or Punjab No. 17, is available. Punjab No. 8 B and Punjab No. 17 are reported as very good bread wheats, but they do not yield as well as does Punjab 8 A.

Club and durum varieties are not very important in the Punjab. The wheats of the Punjab are not divided into spring and winter wheats as the wheat is invariably fall sown in the comparatively mild temperature that prevails there.

The samples of the variety Punjab No. 8A were collected from 10 different points in the Punjab with a view to ascertaining the limits of variation within a variety and the bearing of environment on the milling and baking properties. The points at which these samples were grown are shown in Table 118 under the laboratory numbers 15296, 15297, 15300, 15301, 15302, 15305, 15306, 15307, 15308, and 15309.

The results of the milling and baking tests of these varieties are given in Tables 119 and 120.

TABLE 118.—*Wheats grown in India: Description and characteristics of the variety samples*

Laboratory No.	Province where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14764	Central [1]	Red Pissi	Hard red winter	1 Hard Winter	0.0	46.8	62.1	3.8	0.2	0.1
14767	do. [2]	Bansi	Durum	1 Amber Durum	.0	85.3	60.4	4.9	.0	.0
14766	do. [3]	Howrah	do.	1 Durum	.0	52.2	61.1	4.0	.1	.0
14765	do. [4]	Mundi	White	1 Hard White	1.7	83.8	63.5	3.2	.3	.0
14768	do. [2]	White Pissi	do.	do.	.0	87.6	61.9	4.1	.0	.0
14763	do. [1]	Kathia	Red poulard		.9	52.9	59.2	4.7	4.2	.0
14591	North-West Frontier [5]	Marquis	Hard red spring	1 Hard Spring	.3	97.4	60.9	3.2	.0	.0
14592	do. [5]	Pusa No. 4	White	3 Hard White	.0	99.6	62.0	4.4	4.4	.0
14593	do. [5]	Pusa 80.5	do.	2 Soft White	.0	72.4	63.4	3.9	2.6	.0
14594	do. [5]	Federation	do.	3 Soft White	.0	65.1	62.0	4.1	4.6	.0
15292	Punjab [6]	Punjab No. 14	Soft red winter	1 Western Red	.0		63.9	3.4	.0	.0
15295	do. [7]	do.	do.	do.	.0		61.7	3.5	.0	.1
15294	do. [8]	do.	do.	do.	.0		62.1	3.0	.1	.1
15293	do. [9]	do.	do.	do.	.0		61.5	3.6	.1	.0
15308	do. [8]	Punjab No. 8-A	White	1 Hard White	.0	93.1	63.8	4.0	.6	.0
15307	do. [10]	do.	do.	do.	.0	79.4	62.5	3.9	0	.0
15297	do. [8]	do.	do.	do.	.0	83.6	61.7	3.4	.1	.0
15305	do. [11]	do.	do.	do.	.0	91.2	62.1	3.7	.1	.0
15302	do. [12]	do.	do.	do.	.0	81.5	62.0	3.7	.0	.1
15309	do. [13]	do.	do.	do.	.0	90.0	63.1	3.7	.8	.0
15303	do. [14]	do.	do.	1 Soft White	.0	35.6	61.8	3.9	.1	.2
15301	do. [7]	do.	do.	do.	.0	59.6	62.3	4.1	.0	.0
15300	do. [15]	do.	do.	do.	.0	34.4	62.3	4.3	.0	.0
15296	do. [9]	do.	do.	do.	.0	30.8	61.1	3.8	.0	.0
15303	do. [6]	Punjab No. 8-B	do.	1 Hard White	.0	98.9	63.6	3.2	.1	.1
15304	do. [15]	do.	do.	do.	.0	98.1	63.1	3.8	.0	.0
15311	do. [8]	do.	do.	do.	.0	95.4	61.1	3.2	.0	.1
15299	do. [7]	Punjab No. 11	do.	do.	.0	89.6	62.7	3.4	.0	.0
15310	do. [6]	do.	do.	1 Soft White	.0	64.8	64.3	3.4	.0	.0
15298	do. [6]	Punjab No. 17	do.	1 Hard White	.0	87.1	63.0	3.7	.2	.0

[1] Grown at Raipur Experimental Station, Central Province.
[2] Grown at Hoshangabad Experimental Station, Central Province.
[3] Grown at Nagpur Experimental Station, Central Province.
[4] Grown at Jubbulpore Experiment Station, Central Province.
[5] Grown at the Agricultural Experiment Station, Tarnab, district of Peshawar.
[6] Grown at Lyallpur botanical farm, Punjab, canal irrigated.
[7] Grown at Hansi agricultural farm, Punjab, canal irrigated.
[8] Grown at Gurdaspur agricultural farm, Punjab, nonirrigated.
[9] Grown at Rawal Pindi district, Punjab, private farm, nonirrigated.
[10] Grown at Lyallpur agricultural farm, Punjab, canal irrigated.
[11] Grown at Montgomery seed farm, Punjab, canal irrigated.
[12] Grown at Jullundhur D. B. farm, Punjab, well irrigated.
[13] Grown at Jullundhur district, Punjab, private farm, well irrigated.
[14] Grown at Sargodha seed farm, Punjab, canal irrigated.
[15] Grown at Gurdaspur agricultural farm, Punjab, well irrigated.

TABLE 119.—*Wheats grown in India: Milling properties of the variety samples described in Table 118, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14764	63.3	1.6	10.8	75.4	74.2	256	Hard	Granular	White	0.83	0.64	1.70	6.55	0.244	9.97	9.37	3.46	4.40	7.86	44.02	3.16
14767	61.6	3.6	9.8	75.1	72.4	260	Very hard	do	Creamy	1.20	.73	1.41	6.64	.212	9.61	8.72	2.78	4.62	7.40	37.57	4.30
14766	61.8	3.8	9.9	75.8	72.9	258	do	do	do	.90	.91	2.58	6.64	.192	10.40	9.73	3.06	5.19	8.25	37.09	3.64
14765	64.7	3.9	9.6	72.8	70.0	268	Hard	do	White	1.02	.92	2.33	6.70	.211	10.39	9.28	3.55	4.01	7.56	46.96	3.21
14768	61.6	2.7	10.3	72.2	70.3	269	do	do	do	1.11	.64	1.34	6.57	.162	10.07	8.71	3.08	4.16	7.24	42.54	2.98
14763	59.7	3.8	10.3	70.9	68.2	277	do	do	do	.67	.90	1.85	6.41	.394	12.48	11.29	3.79	5.90	9.69	39.11	2.99
14591	62.2	.9	11.5	74.5	73.7	260	do	do	Slightly creamy	1.06	.55	1.83	6.60	.331	13.97	12.69	4.69	6.30	10.99	42.68	2.56
14592	62.4	1.2	11.5	75.1	74.1	259	Very hard	do	do	1.09	.56	1.83	6.53	.293	14.19	13.32	4.80	6.60	11.40	42.10	3.05
14593	64.4	1.3	11.5	75.5	75.7	253	Hard	do	do	1.18	.64	1.62	6.60	.303	9.78	9.14	3.16	4.54	7.70	41.04	3.35
14594	63.2	1.6	11.4	74.9	74.2	258	do	do	do	1.38	.72	1.79	6.66	.275	9.48	8.46	2.95	3.96	6.91	42.69	2.44
15292	65.0	1.3	9.7	71.8	71.1	264	Semihard	Soft	do	1.77	.50	1.37	(1)	(1)	9.74	8.62	3.17	3.90	7.07	44.87	(2)
15295	63.2	1.5	9.6	72.7	71.8	262	do	Granular	do	1.60	.61	1.61	(1)	(1)	7.51	6.96	2.55	2.86	5.41	47.13	(2)
15294	63.7	1.2	9.7	72.4	71.5	263	Hard	do	do	1.39	.55	1.57	(1)	(1)	10.41	9.42	3.41	4.47	7.88	43.27	(2)
15293	63.2	1.6	10.4	72.6	71.5	265	Semihard	Soft	do	1.54	.57	1.66	(1)	(1)	11.31	10.17	3.68	4.67	8.35	44.07	(2)
15308	64.7	1.4	9.6	75.8	74.8	252	Hard	Granular	do	1.56	.64	1.54	(1)	(1)	11.90	11.07	3.83	5.41	9.24	41.45	(2)
15307	63.3	1.3	9.4	75.7	74.6	251	do	do	do	1.77	.64	1.41	(1)	(1)	9.70	9.08	3.02	4.35	7.37	40.98	(2)
15297	62.8	1.4	9.8	73.6	72.7	259	do	do	do	1.89	.61	1.49	(1)	(1)	9.63	8.97	3.35	3.85	7.20	46.53	(2)
15305	62.6	1.5	9.3	75.1	73.9	253	do	do	do	1.71	.61	1.39	(1)	(1)	11.56	10.72	3.66	5.22	8.88	41.22	(2)
15302	62.4	1.6	9.5	74.0	73.0	257	do	do	do	1.65	.66	1.88	(1)	(1)	9.50	8.82	3.35	3.81	7.16	46.79	(2)
15309	63.6	1.5	9.6	75.2	74.2	253	do	do	do	1.65	.63	1.73	(1)	(1)	10.52	9.93	3.90	4.16	8.06	48.39	(2)
15306	62.4	.9	9.4	------	75.3	250	do	do	do	1.68	.65	1.48	(1)	(1)	7.56	6.90	2.30	3.04	5.34	43.07	(2)
15301	62.9	1.5	9.5	75.1	74.0	253	Semihard	do	do	1.70	.63	1.36	(1)	(1)	8.72	8.06	2.64	3.64	6.28	42.04	(2)
15300	63.1	1.6	9.7	74.0	72.8	258	Hard	do	do	1.75	.70	1.83	(1)	(1)	8.11	7.28	2.78	3.01	5.79	48.01	(2)
15296	61.9	1.5	10.2	71.5	70.5	268	Semihard	do	do	1.93	.60	1.67	(1)	(1)	7.40	6.52	2.36	2.69	5.05	46.73	(2)
15303	64.2	.9	9.5	72.3	71.6	262	Hard	do	do	1.43	.60	1.36	(1)	(1)	13.97	13.21	5.06	5.75	10.81	46.81	(2)
15304	64.1	1.7	9.7	73.1	71.9	261	do	do	White	1.08	.64	1.74	(1)	(1)	11.22	10.65	3.58	5.23	8.81	40.64	(2)
15311	62.2	1.8	9.7	74.1	72.8	258	do	do	do	1.55	.59	1.60	(1)	(1)	10.93	10.37	3.47	5.26	8.73	39.75	(2)
15299	64.1	1.7	9.7	73.9	72.6	259	do	do	do	1.26	.61	1.46	(1)	(1)	9.15	8.45	2.86	3.82	6.68	42.81	(2)
15310	65.6	1.0	9.8	76.5	75.8	248	do	do	do	1.57	.60	1.31	(1)	(1)	9.90	9.30	3.43	3.78	7.21	47.57	(2)
15298	63.9	1.5	9.4	74.4	73.3	255	do	do	do	1.78	.55	1.45	(1)	(1)	9.86	9.30	3.21	4.67	7.88	40.74	(2)

[1] No test on account of Naphthalene in samples.

TABLE 120.—*Wheats grown in India: Baking properties of the variety samples described in Tables 118 and 119*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14764	161	73	61.5	1,760	513	88	76	Fair	Light creamy	Light brown	Very poor	296
14767	170	72	63.3	1,550	533	78	76	Poor	Very, very creamy	Foxy brown	do	307
14766	158	78	61.6	1,800	497	78	83	Fair	Creamy, gray	Light brown	Poor	287
14765	127	60	65.0	1,650	518	72	60	Poor, crumbly	do	do	Very poor	299
14768	156	73	55.1	1,800	499	82	80	Fair, crumbly	Creamy, gray	Very pale	Poor	288
14763	161	58	62.8	1,770	511	54	62	Poor, crumbly	do	Light brown	Very poor	295
14591	133	71	61.6	2,390	499	91	93	Good	Light creamy	do	Fair	288
14592	147	68	65.8	2,070	521	86	83	do	Creamy	Brown	do	300
14593	160	71	65.7	1,740	527	86	82	Poor, crumbly	do	do	do	304
14594	147	78	60.7	1,780	509	84	81	do	do	Light brown	Poor	293
15292	125	61	59.7	1,690	503	79	74	do	Very creamy	do	Very poor	290
15295	127	60	61.3	1,450	510	66	50	Very poor, crumbly	do	Very pale	do	294
15294	153	64	65.7	1,640	526	79	76	Poor, crumbly	Creamy, gray	Brown	do	303
15293	120	61	63.4	1,740	513	80	78	do	Creamy	do	do	296
15308	143	59	66.9	1,770	527	84	81	do	do	do	Poor	304
15307	149	70	64.4	1,620	520	82	77	Poor	do	Light brown	Very poor	300
15297	150	68	66.0	1,620	524	78	75	Poor, crumbly	Very creamy	Brown	do	302
15305	137	60	66.3	1,810	522	82	79	Poor	Creamy	do	Poor	301
15302	149	78	65.2	1,690	523	80	72	Poor, crumbly	Very creamy	do	Very poor	301
15309	143	63	66.0	1,710	528	84	80	Poor	Creamy	do	Poor	304
15306	148	70	61.7	1,540	512	78	70	do	Creamy, gray	Very pale	Very poor	295
15301	140	70	64.6	1,620	519	78	70	Poor, crumbly	Very creamy	Brown	do	299
15300	140	71	65.5	1,570	526	80	72	do	do	Light brown	do	303
15296	152	67	60.9	1,540	510	80	77	Very poor	do	Very pale	do	294
15303	143	71	71.2	1,920	533	87	88	Excellent	Creamy	Brown	Fair	307
15304	145	71	66.0	1,890	522	88	84	Fair, crumbly	Light creamy	do	Poor	301
15311	134	72	64.8	1,640	516	86	82	Poor	Creamy	do	do	297
15299	133	63	66.9	1,530	521	82	71	Poor, crumbly	do	do	Very poor	300
15310	129	66	61.7	1,560	509	80	72	Poor	do	do	Poor	293
15298	143	67	66.3	1,860	522	82	84	Fair	do	do	Very poor	301

The moisture content of the Indian wheats examined was rather low, averaging about 10 per cent, the extremes being 9.3 and 11.5 per cent. Since Indian wheats can absorb so much moisture their purchase must be somewhat profitable.

Partly because of the low moisture content of Indian wheats, and partly because of their plump condition, the test weight per bushel was, with but one or two exceptions, rather high, and the flour yields obtained therefrom averaged the highest of any of this class of wheat tested from any source throughout the world. The flour was soft to granular in character, creamy white in color, and of high ash content, especially as compared with flour milled from white wheats grown in Australia or North America.

Describing his experiences with Indian wheat, Kent-Jones (*5, p. 36*) states that—

> while not strong in the usually accepted sense, most Indian wheats are able to impart to a blend that stability which is so often desired. * * * The real strength of Indian wheats can be seen when mixed with Russian wheats. * * * To get the best out of Indian wheats * * * they should be conditioned, if possible, so that the proteolytic enzymes are encouraged. * * * Their protein is too coagulated.

INDIAN EXPORT WHEATS

The quantity of wheat exported from India varies with the home demand. In the five years before the World War the export trade of India was considerable, averaging over 50,000,000 bushels annually. Since the war this trade has become very erratic and is now believed by many to be in a moribund condition. In 1926–27 total exports were 11,088,000 bushels, and in 1927–28 they were 14,328,000 bushels. Most of the exported wheat goes to the United Kingdom and is used to fill the gap between the Australian and North American imports.

On an average the protein content of the majority of the Indian wheats tested, as well as the protein content of the flour milled from them, was low. Exceptions are found in the wheats received from the North-West Frontier Province. Two of the varieties from this Province were of exceptionally high protein content. The low average protein content would indicate limited baking strength. However, Indian wheats evidently have excellent milling properties.

As to baking qualities, it is apparent that the majority of the white and soft red winter wheats of India lack baking strength. The volume of the loaf of bread was low, and the loaf was coarse in texture and of undesirable color. The North American variety Marquis, however, proved to be an excellent wheat from both the milling and baking standpoints. Of the two durum varieties, Bansi and Howrah, Howrah had by far the better baking quality. In no way do the baking properties of the white wheats of India compare with the baking quality of the white wheats grown in Australia or North America; they resemble rather those of the white wheats of continental Europe as far as baking strength is concerned. In milling value, however, they outrank all the other white wheats of the world.

As long as supplies of Indian wheat were regular, English millers invariably used them in their mixtures and the trade was profitable to all concerned. On account of the greatly increased consumption of wheat by the people of India, now about 320,000,000 bushels a

year, due to a steady rise in the standard of living all over the country, exports of Indian wheat have become very irregular. Naturally buyers lose interest in irregular supplies, so that Indian export wheat is not now as popular as it used to be.

Karachi wheat is one of the most common types of Indian export wheat. Through the courtesy of the grain-sampling bureau, heretofore mentioned, samples of three cargoes of Karachi wheat unloaded in England were examined for milling and baking properties. The samples of all three cargoes graded as mixed wheat because of admixtures of spring, durum, and winter classes in the white wheat. Test weight per Winchester bushel varied from 60 to 60.4 pounds. This was somewhat lower than was the case with the pure varieties. (Tables 118, 119, and 120.) Nevertheless the export wheats gave a good yield of flour, the three samples averaging 74 per cent. The flour had the same characteristics as the flour milled from the pure varieties of wheat and its baking characteristics were similar. Apparently Indian wheats should be blended with other wheats to obtain the best results.

IRAQ

Production of wheat in Iraq, formerly a part of Turkey, lying between the Tigris and Euphrates Rivers (since the World War a British Protectorate), amounted to an average of 4,000,000 bushels annually in the years 1924–26.

According to F. K. Jackson, inspector general of agriculture at Bagdad, Iraq, the local types of wheat are gradually dying out and are being replaced by more promising varieties from other countries. Samples of nine of these promising selections were forwarded for milling and baking tests. A description of the samples and the results of the tests are given in Tables 121, 122, and 123.

Three of these selections were classified as durum wheats and six as white wheats. From a milling standpoint the durum varieties were below average because of low test weight per bushel, low yield of flour, or both. On the other hand, with but one exception, the test weight and flour yield of the white varieties was very good. As is usual with white wheats, the protein present was low in the majority of instances.

The baking quality of two of the durum varieties was very poor. The third variety, Durum Leucomelan, exhibited fairly good baking strength.

Half of the white varieties (Clarendon, Nyngan No. 3, and Comeback) had good baking strength. The other three (Punjab No. 8 B, Punjab No. 11, and Punjab No. 17) produced flour typical of the white wheats of India, that is, of poor baking strength when used alone. It is expected that the quality of the wheats grown in Iraq will be improved through the selection program now in progress.

TABLE 121.—*Wheats grown in Iraq: Description and characteristics of the variety samples*

Laboratory No.	Where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14243	(1)	Durum Valenciae	Durum	1 Amber Durum	0.0	82.7	60.2	3.9	0.2	0.1
14242	(1)	Durum Leucomelan	do	5 Amber Durum	.0	91.2	53.8	4.0	.0	.3
14244	(1)	Durum Libycum	do	2 Red Durum	.0	3.0	58.8	3.6	.0	.1
14249	(1)	Punjab 8 B	White	1 Hard White	.0	3.6	62.3	3.6	.0	.3
14245	(1)	Clarendon	do	2 Hard White	.0	92.4	61.9	4.3	.0	.0
14247	(1)	Nyngan No. 3	do	do	.0	83.2	59.0	3.4	.0	.0
14246	(1)	Comeback	do	1 Soft White	.0	67.6	61.5	3.5	.0	.0
14248	(1)	Punjab No. 17	do	do	.0	43.4	60.3	3.9	.0	.0
14250	(1)	Punjab No. 11	do	do	.0	44.8	61.5	3.0	.2	.0

[1] No information available.

TABLE 122.—*Wheats grown in Iraq: Milling properties of the variety samples described in Table 121, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Glindin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14243	61.9	2.6	10.2	70.0	68.2	277	Very hard	Granular	White	0.79	0.83	1.82	6.65	0.313	10.15	9.40	3.00	4.90	7.90	37.97	2.76
14242	53.2	4.4	9.7	64.5	61.2	307	do	do	Slightly creamy	1.09	.98	2.32	6.61	.459	12.51	12.09	3.77	6.68	10.45	36.08	3.61
14244	59.5	2.9	10.1	68.8	66.8	282	do	do	Creamy	2.03	.72	1.71	6.61	.350	8.60	7.45	2.42	3.90	6.32	38.29	3.41
14249	63.1	1.1	9.9	75.7	74.9	251	Hard	Soft	Slightly creamy	1.10	.51	1.50	6.63	.258	10.27	9.37	3.05	4.87	7.92	38.51	4.72
14245	61.4	2.2	10.0	68.3	66.8	282	Soft	Very soft	White	.74	.43	1.42	6.68	.248	9.77	8.53	2.87	4.12	6.99	41.06	2.79
14247	59.4	2.0	10.2	71.4	69.9	270	Semihard	do	do	1.02	.47	1.58	6.60	.323	10.39	9.76	3.15	5.25	8.40	37.50	3.70
14246	62.6	3.7	10.2	73.6	70.8	267	Hard	do	do	1.05	.45	1.56	6.69	.248	10.88	10.00	3.27	5.24	8.51	38.43	3.80
14248	61.6	1.5	10.2	70.7	69.6	271	Semihard	do	do	1.39	.57	1.62	6.66	.258	7.95	7.28	2.23	3.76	5.99	37.23	3.76
14250	62.1	1.3	10.3	72.0	71.1	266	Hard	do	do	1.26	.60	1.40	6.70	.203	8.46	7.73	2.71	3.61	6.32	42.88	3.99

TABLE 123.—*Wheats grown in Iraq: Baking properties of the variety samples described in Tables 121 and 122*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14243	127	55	64.8	1,400	536	86	46	Poor	Creamy	Brown	Poor	309
14242	130	58	64.8	1,840	527	84	90	Excellent	do	do	do	304
14244	132	53	60.6	1,410	521	79	51	Poor	Very creamy	do	do	300
14249	105	60	62.5	1,680	524	86	68	do	Creamy	Light brown	do	302
14245	114	63	60.0	1,900	513	90	92	Good	do	Pale	do	296
14247	110	64	58.3	1,930	512	88	90	Fair	do	Light brown	Fair	295
14246	105	68	58.6	1,790	512	87	64	do	do	Pale	Poor	295
14248	105	65	57.8	1,610	507	82	58	Poor	Very creamy	Light brown	do	292
14250	108	54	57.5	1,570	513	80	53	do	do	Pale	do	296

JAPAN

The trend of wheat production in Japan is upward. Production in 1928 was nearly 31,000,000 bushels. Imports are variable. In 1924–25 about 15,000,000 bushels were imported. The estimated importation for 1925–26 was nearly 28,000,000 bushels. Exports of wheat from Japan are chiefly in the form of flour sent to China and Siam.

Common red and white wheats of spring and winter habit are prominently grown. Durum and club wheats are also grown to a limited extent. Among the wheat varieties of commercial importance grown in Japan are Akobozu No. 1, Akakawa Aka, Daruma, Igachikugo, Martin Amber, Shirobunbu, Soshu, Sapporo Harukomuki No. 9, and Sapporo Harukomuki No. 10.

Requests were made to various agricultural authorities in Japan for samples of all of these varieties for the purpose of testing their milling and baking properties. Through the courtesy of Takatsugu Abiko, agronomist of the Hokushu Agricultural Experiment Station at Sapporo, Japan, samples of Martin Amber, Sapporo Harukomuki No. 9, and Sapporo Harukomuki No. 10, were received. A sample of Akakawa Aka (Red Chaff Red) was sent but was lost in transit. The loss was very unfortunate because this variety is said to be representative of about 34 per cent of the winter wheat grown in the Prefecture of Hokushu. The variety Martin Amber is also said to be of winter habit, and is representative of about 41 per cent of the winter wheat grown in this Prefecture.

The varieties Sapporo Harukomuki No. 9 and No. 10 represent 76 per cent and 5 per cent, respectively, of the wheat of spring habit grown in the Prefecture of Hokushu. No club or durum wheats are grown there.

The director of the Kumamoto Agricultural Experiment Station, S. Tanji, located at Kumamoto, Japan, sent samples of the varieties Akobozu No. 1, and Shirobunbu. Both were said to be of winter habit, and the samples were grown at the experiment station. Akobozu No. 1, is representative of about 27.3 per cent of all the winter wheat grown in Prefecture of Kumamoto. In 1926, 14,463 acres were sown to this variety. Shirobunbu is representative of 10.1 per cent of the winter wheat grown in this Prefecture; in 1926, 5,369 acres of it were sown.

Director H. Ando, of the Imperial Agricultural Experiment Station, located at Nishigahara, Tokyo, Japan, forwarded samples of the varieties Soshu, Daruma, and Igachikugo. He stated that the variety Soshu is of winter habit and is representative of the wheat grown in northern Japan. Daruma is commercially important in the Kanto district which surrounds Tokyo.

Igachikugo is the most important commercial variety that occurs in the southern parts of Japan. It is produced chiefly in the districts of Chugoku and Kyushu. The wheat sent was grown at the Saga agricultural farm, Saga Prefecture, Kyushu.

In addition to the samples of the above varieties a sample of the "native wheat" grown in Chosen (Korea), was received from S. Kato, director of the agricultural experiment station located at Suigen, Chosen, Japan. This is a soft red winter variety. Unfortunately the sample was not large enough to make a milling and baking test.

Results of the milling and baking tests of Japanese wheats are given in Tables 124, 125, and 126.

TABLE 124.—*Wheats grown in Japan: Description and characteristics of the variety samples*

Laboratory No.	Place where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13522	Agricultural experiment station, Kumamoto.	Akobozu No. 1	Hard red spring	1 Northern Spring	0.0	57.8	60.3	2.7	0.3	0.0
13893	Agricultural experiment station, Hokushu.	Sapporo Harukomuki No. 9.	do	do	.0	59.0	61.6	4.9	.2	.0
13678	Agricultural experiment station, Konosu.	Daruma	do	3 Northern Spring	.0	60.5	55.8	3.0	1.8	.0
13679	do	Soshu	do	2 Red Spring	.2	6.0	57.3	3.4	1.2	.0
13523	Agricultural experiment station, Kumamoto.	Shirobunbu	Soft red winter	1 Red Winter	.0		60.7	2.9	.5	.2
5568	Chosen [1]	Native variety	do	do	.0		60.5	3.3	1.0	.0
13680	Agricultural experiment station, Saga.	Igachikugo	do	do	.0		60.2	2.5	.5	.0
14105	Agricultural experiment station, Hokushu.	Martin Amber	White	1 Hard White	.0	97.8	62.9	3.9	.0	.0
13990	do	Sapporo Harukomuki No. 10.	do	3 Soft White	.0	67.6	61.1	4.1	4.9	.0

[1] Commercial sample.

TABLE 125.—*Wheats grown in Japan: Milling properties of the variety samples described in Table 124, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13522	63.0	0.7	13.0	67.9	67.4	289	Soft	Very soft	White	1.48	0.40	1.75	6.31	0.342	10.31	9.41	3.17	4.92	8.09	39.18	2.48
13893	62.6	1.1	10.5	71.1	70.3	269	do	Soft	do	1.25	.60	1.94	6.43	.516	12.56	11.70	4.16	5.33	9.39	38.98	1.96
13678	58.1	1.8	11.5	63.1	62.0	309	do	do	Slightly creamy	1.63	.44	1.68	6.67	.232	12.59	10.99	3.91	5.67	9.58	40.81	1.73
13679	59.5	1.5	11.8	67.9	66.9	287	do	do	White	1.27	.38	1.61	6.43	.272	10.27	8.93	3.26	4.25	7.50	43.47	2.16
13523	62.4	1.0	13.2	72.6	71.8	272	do	Very soft	do	1.22	.42	1.61	6.35	.346	11.26	9.97	3.49	5.29	8.78	39.75	2.41
13680	62.0	1.3	11.8	66.6	65.7	293	do	do	Creamy	2.19	.49	1.69	6.44	.388	8.65	7.82	3.12	3.26	6.38	48.90	2.18
14105	63.4	1.9	11.5	75.7	74.3	258	do	Soft	White	1.15	.51	1.54	6.49	.327	10.90	10.04	3.44	5.01	8.45	40.71	2.00
13990	62.5	1.5	9.8	74.3	73.3	256	do	do	do	1.21	.60	1.77	6.42	.432	11.33	10.46	4.05	4.59	8.64	46.88	2.12
13568[1]																					

[1] Not sufficient for milling purposes.

TABLE 126.—*Wheats grown in Japan: Baking properties of the variety samples described in Tables 124 and 125*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13522	137	63	56.3	2,270	491	91	93	Very good	Light creamy	Pale	Poor	283
13893	100	41	50.0	1,400	495	80	11	Very poor, crumbly	Creamy, gray	Brown	No break	285
13678	104	58	53.4	1,920	494	84	75	Poor, crumbly	do	do	Fair	285
13679	108	64	55.4	1,880	494	89	82	Fair, crumbly	Creamy	Pale	Poor	285
13523	135	59	57.8	2,060	504	88	90	Good	Creamy, gray	do		291
13568[1]												
13680	112	60	53.4	1,730	495	81	68	Poor, crumbly	Creamy	Pale	Poor	285
14105	107	57	51.0	1,880	494	84	62	do	do	Light brown	do	285
13990	107	45	54.4	1,540	498	72	11	Very poor, crumbly	Creamy, gray	do	do	287
14526[1]												

[1] Not baked.

All the Japanese wheats milled easily. The greatest yield of flour was obtained from the white-wheat varieties. Martin Amber and Sapporo No. 10 had the best milling quality. Their performance compared very favorably with the milling performance of wheats of similar classification grown in India and Australia. The milling quality of the varieties Sapporo No. 9 and Shirobunbu was also good. All the other Japanese varieties tested below average in quality.

The baking quality of the flours milled from the Japanese wheats was variable. Of outstanding importance is the baking quality of Sapporo No. 9 and Sapporo No. 10, as both varieties showed excellent milling quality, but the flour from these varieties was practically devoid of strength, as the resulting loaves were very small in volume, 1,400 and 1,540 cubic centimeters, respectively. The texture of the loaves was poor and crumbly, and the break and shred was indicative of poor gluten strength. Akobozu No. 1 and Shirobunbu, on the other hand, exhibited very much better baking properties. The volume of the loaves was good, as was the color, grain, and texture of the crumb. Crust color, however, was poor, indicating lack of diastatic activity. The flour milled from the other varieties was variable in strength. Although the volume of the resulting loaf, in many cases, was fairly good, the size was attained by sacrificing quality of loaf for size of loaf. The color, grain, and texture of the loaf was not good, nor was the color of the crust nor the break and shred of the loaf.

Strong wheats from overseas, if blended with Japanese wheats, should help to stabilize the baking qualities of the Japanese wheat flours.

PALESTINE

Acreage devoted to wheat production in Palestine is not extensive. The most important factor limiting production is the climate. The usual delay in rains during December and January, insufficiency of rain in April, and the absolute lack of rain in May, accompanied by hot drying winds (sirocco) which blow for many days toward the end of April or the first of June, are disastrous to the successful production of cereals.

Durum and poulard wheats are chiefly grown. The most important durum varieties are Kaf el Ruhamau, grown extensively in Judea and Samaria; Katrani, a drought-resistant variety, extensively cultivated in the coastal sections; Noorsi, cultivated on the plains of Sarona and Gaza, and Jaljooli, grown extensively in the Haifa district. Sarim, a very hard type, does well on the red clay soil of Hauran and in the Valley of the Jordan, but does not thrive elsewhere.

Haiti is the most prominent variety of poulard wheat.

Samples of the two durum varieties, Noorsi and Jaljooli, and of the poulard variety Haiti, were obtained from the Palestine Jewish Colonization Association, through the courtesy of Amram Khazanoff, and their milling and baking properties were determined. Data resulting from this investigation are given in Tables 127, 128, and 129.

TABLE 127.—*Wheats grown in Palestine: Description and characteristics of the variety samples*

Laboratory No.	District where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
14212	Haifa	Jaljooli	Durum	1 Amber Durum	0	99.7	62.7	4.2	0.0	0
14213	Tiberias	Noorsi	do	2 Amber Durum	0	99.7	59.8	3.4	.0	0
14211	Safed	Haiti	White poulard		0	95.8	62.2	3.9	.1	0

TABLE 128.—*Wheats grown in Palestine: Milling properties of the variety samples described in Table 127, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Grotheriangle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14212	62.6	3.2	9.1	71.9	69.8	267	Very hard	Granular	White	0.90	0.91	1.53	6.42	0.479	12.09	11.86	4.10	6.04	10.14	40.43	3.57
14213	60.5	3.0	9.1	68.8	66.6	280	do	do	Slightly creamy	1.22	.82	1.68	6.59	.314	12.74	12.18	3.64	6.81	10.45	34.83	3.85
14211	62.5	2.4	9.2	71.1	69.4	269	do	do	Creamy yellow	2.63	.89	1.75	6.54	.401	12.21	12.00	4.12	6.11	10.33	40.85	3.15

TABLE 129.—*Wheats grown in Palestine: Baking properties of the variety samples described in Tables 127 and 128*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14212	142	57	66.9	1,530	539	80	60	Poor	Very creamy	Brown	Poor	305
14213	129	62	63.8	1,700	527	78	63	do	do	do	do	304
14211	129	61	64.1	1,690	538	82	80	do	do	do	do	310

Of the two durum varieties, Noorsi was the poorer as far as milling properties were concerned, but it had a greater baking strength than did the variety Jaljooli.

The milling quality of the poulard variety was good, but its baking strength was poor.

The milling and baking qualities of the Palestine varieties are in line with milling and baking properties of wheats of similar classes grown in Egypt, Tunis, Morocco, and Greece, but are greatly inferior to the milling and baking properties of the durum wheats grown in North America and continental Europe.

OTHER ASIATIC COUNTRIES

Because of the unsettled conditions in China and Manchuria at the time this study was made, it was not possible to obtain samples of wheats from these countries. However, information accumulated by B. W. Whitlock, in charge of the Pacific coast headquarters of the Grain Division of the Bureau of Agricultural Economics, who made a survey of the wheat situation in the Orient in 1924, is as follows:

In China, soft red winter and white wheats predominate. The wheat of the Yangtse Valley is largely soft red winter wheat. As a rule it is dirty, weevily, and heat damaged, and sells for about two-thirds of the price of imported wheat. The wheat of the Yellow River Valley and the Shantung Peninsula is largely white wheat of a vitreous nature. It, too, is marketed in a dirty and damaged condition.

In Manchuria, spring wheats predominate. They are of moderate strength, resembling wheat of the Pacific Northwest, but they are extremely dirty wheats and are often smutty; they mill into a flour of poor color and flavor. They often carry an earthy odor, and for this reason it is dangerous to use too high a proportion of Manchurian wheats in blending.

MILLING AND BAKING QUALITIES OF WHEATS GROWN IN OCEANIA

Australia and New Zealand represent the wheat-growing countries of Oceania. Results of the milling and baking properties of the wheats grown in these countries are described in the following pages.

AUSTRALIA

Australia ranks ninth among the countries in the production of wheat. The wheat acreage in Australia has been increasing since 1860. Since 1895 an area equivalent to 300,000 acres has been added annually. The acreage devoted to the production of wheat reached a maximum in 1915–16 because of the influence of the World War. After this date there was a decrease until 1920–21. Since 1921 there has been a marked advance in acreage, particularly in Western Australia. In 1928, the acreage planted was the greatest ever sown. Wheat exceeds any other crop in importance, as it involves about 60 per cent of the acreage under cultivation.

New South Wales has the largest acreage, closely followed by the States of Victoria, South Australia, and Western Australia. As compared with the acreage in these States, the acreage under wheat in Queensland and Tasmania is of relatively small importance.

The highest average yields per acre for the period 1916–1926 were those in Tasmania and Victoria, followed in order by those in Queensland, South Australia, New South Wales, and Western Australia.

The Australian wheat belt forms a more or less crescent-shaped area in the southern portion of the continent and a similar but much smaller territory to the southwest. According to A. E. V. Richardson, director of the Waite Agricultural Institute, the inner margin of the Australian wheat belt is determined by aridity and the outer margin by increased humidity and mountain relief. Lack of transportation facilities in Riverina and in Western Australia limit the expansion of the wheat acreage.

Lack of moisture is an important factor limiting wheat yields in the important wheat areas. Other climatic factors influencing production are excessive heat and frost. Heat has an important bearing on production throughout Australia, varying in intensity in various wheat-producing sections. Frosts are of importance in Tasmania and Queensland and in some districts in South Australia.

The varieties of wheats grown commercially in Australia are mainly common white wheats of winter habit. No wheats of the strictly winter type are grown. Although wheats are sown in the fall in Australia, because of the short growing period, it is impossible to secure reasonably good results with wheats of the winter type that are typical of countries that have long growing seasons. The wheats of Australia are, therefore, classified as early, midseason, and late.

In South Australia there are no late wheats. The early type of wheat is better adapted for this section of Australia, although the midseason wheats return heavier yields in late season.

AUSTRALIAN VARIETIES

Varieties of commercial importance grown in South Australia are Gluyas Early, Gluyas Late, Federation, Currawa, Major, Queen Fan, and Caliph. Gluyas Early and Caliph are early varieties. Gluyas Early is typical of the wheat grown in South Australia. It is more or less rust resistant. Gluyas Late is a selection from Gluyas Early, ripening about a week later than Gluyas Early. Federation, Currawa, Major, and Queen Fan may be described as midseason varieties.

In the State of Western Australia common white wheats represent the major portion of the crop. Red varieties have gone out of cultivation, as they reduced the market value of the grain. Durum and club varieties are not grown commercially.

Statistics are not available regarding acreage and production of all the varieties under cultivation in Western Australia. In 1926–27, 2,776,818 acres were sown to wheat. About 47 per cent is sown to the variety Nabawa, an early maturing variety grown extensively throughout the wheat belt, and 14 per cent to the variety Gluyas Early. Other early maturing varieties are Merredin and Noongaar. Yandilla King is a late variety. The varieties Carrabin, Cedar, Florence, and Comeback, are also grown to a varying extent. Carrabin is a promising variety of hard texture and good acre yields. Comeback and Florence are now only sparsely grown because, even though they are two of the best milling wheats in Western Australia, acre yields are rather low.

As is the case in Western Australia and South Australia, the white wheats form the major portion of the commercial varieties sown in the State of Victoria. Durum and club varieties are likewise not grown commercially. Only one or two varieties of red wheats are grown commercially, and their production is declining because of the desire that all of the Australian wheat marketed overseas be of uniform type. Among the white wheats grown in Victoria, the varieties Federation, Major, and Currawa are most important. Federation comprises over 60 per cent of the wheat grown in Victoria. Of the red winter wheats, Red Russian alone represents the bread wheats. Its area of production is small. The variety Warden is used extensively for the production of hay in the hay districts near Melbourne.

In New South Wales only red and white spring wheats of the *vulgare* species are grown. Ninety-seven per cent of the wheat produced is white spring wheat, and 3 per cent is red spring wheat. Red and white winter wheats, durum wheats, and club wheats are not grown. Of the white spring varieties, Federation, Hard Federation, Canberra, Comeback, and Ghurka are important in the order named. Bomen is the most important among the red spring varieties.

The most important wheat varieties cultivated in Tasmania are Braemar Velvet, Federation, Purple Straw, and Farmer Friend. Braemer Velvet is first in importance, especially in the dry zones of north central Tasmania; in the northern and more humid zones it tends toward excessive vegetation and becomes more susceptible to the attacks of disease. This variety is of winter habit.

Federation, also of winter habit, is of secondary importance as compared with Hard Federation. It is grown mostly in southern Tasmania.

Purple Straw, of winter habit, is the principal variety grown in southeast Tasmania.

Through the cooperation of the State Departments of Agriculture in New South Wales, South Australia, Tasmania, Victoria, and Western Australia, a number of samples of wheat representative of the types grown commercially in these States were obtained. They were subjected to milling and baking tests to determine their relative bread-making possibilities. The varieties received from the various States are listed in Table 130. The milling and baking properties of each sample are described in Tables 131 and 132.

TABLE 130.—*Wheats grown in Australia: Description and characteristics of the variety samples*

Laboratory No.	State where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
13351	New South Wales	Bomen	Soft red winter	1 Western Red	0.0		62.5	3.4	0.1	0.0
13352	do	Ghurka	White	1 Hard White	.0	99.5	64.1	4.6	.1	.0
13353	do	Hard Federation	do	do	.0	95.6	62.7	3.6	.0	.0
13355	do	Federation	do	do	.0	88.7	62.2	3.6	.0	.0
13356	do	Canberra	do	do	.0	93.6	62.7	3.8	.0	.0
13361	do	Comeback	do	do	.2	99.8	63.7	4.0	.3	.0
13423	South Australia	Currawa	do	2 Hard White	.0	99.2	59.8	3.8	.1	.0
13425	do	Queen Fan	do	do	.0	87.6	59.3	3.6	.0	.0
13420	do	Gluyas Early	do	3 Hard White	.0	96.2	56.9	3.8	.0	.2
13421	do	Gluyas Late	do	do	.0	90.6	57.6	3.9	.0	.0
13424	do	Major	do	do	.0	95.6	57.8	3.5	.0	.0
13422	do	Federation	do	2 Soft White	.0	71.4	58.6	3.7	.0	.0
13426	do	Caliph	do	do	.0	51.8	59.4	4.1	.0	.0
13347	Tasmania	Federation	do	1 Soft White	.0	34.8	62.9	4.1	.0	.0
14186	do	Braemar Velvet	do	2 Soft White	.0	.5	59.5	4.0	.0	.1
14307	do	Purple Straw	do	1 Mixed (white, 81.9 per cent; soft red winter, 18.1 per cent).	.0		63.0	4.9	.0	.0
13351	Victoria	Warden	Hard red winter	1 Dark Hard Winter	.0	81.2	63.1	3.8	.0	.0
13350	do	Red Russian	Soft red winter	1 Red Winter	.0	97.8	63.2	3.3	.0	.0
13348	do	Federation	White	1 Hard White	.0	87.3	62.8	3.9	.0	.0
13419	do	Currawa	do	do	.0	98.8	61.5	4.6	.0	.0
13349	do	Major	do	2 Hard White	.0	80.6	59.5	4.0	.2	.0
14567	Western Australia	Cedar	Hard red spring	1 Hard Spring	.0	99.9	62.4	3.5	.0	.0
14566	do	Marquis	do	1 Dark Northern Spring	.0	99.9	59.5	2.7	.0	.0
14568	do	Sarragolla	Durum	1 Amber Durum	.0	99.8	60.1	3.9	.0	.0
14569	do	Merredin	White	1 Hard White	3.1	98.5	62.2	3.6	.0	.0
14570	do	Noongnar	do	do	.4	99.5	62.1	4.3	.0	.0
14572	do	Carrabin	do	do	.7	99.4	63.1	3.7	.0	.0
14573	do	Nabawa	do	do	.3	99.8	60.4	4.8	.0	.0
14574	do	Comeback	do	do	.0	90.4	61.3	3.7	.5	.0
14575	do	Gluyas Early	do	do	.0	99.4	60.9	4.0	.0	.0
14577	do	Florence	do	do	.0	99.9	60.5	3.0	.1	.0
14571	do	Yandilla King	do	1 Soft White	.0	30.9	60.7	4.7	.0	.0
14576	do	Clubhead	do	1 Western White	.4		61.8	4.0	.0	.1

TABLE 131.—*Wheats grown in Australia: Milling properties of the variety samples described in Table 130, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
13351	61.1	1.9	11.0	72.4	71.0	268	Soft	Soft	Slightly creamy	1.49	0.40	1.31	6.50	0.207	10.21	9.26	3.52	4.63	8.19	43.19	2.75
13352	63.8	1.5	11.1	71.8	70.7	270	Hard	do	do	.95	.51	1.48	6.54	.272	11.33	10.27	3.87	5.19	9.06	42.72	2.66
13353	61.4	1.3	11.1	68.3	67.4	283	Semihard	do	do	1.26	.49	1.08	6.41	.222	9.97	8.84	3.11	4.53	7.64	40.71	3.26
13355	61.3	1.4	11.7	69.5	68.5	280	Soft	do	Creamy	1.67	.43	1.23	6.46	.198	9.50	8.43	2.95	4.38	7.33	40.25	2.66
13356	62.1	1.4	11.7	69.5	68.6	280	do	do	Slightly creamy	1.36	.44	1.38	6.54	.223	10.60	9.76	3.39	5.41	8.80	38.52	2.84
13364	63.8	1.9	11.4	76.5	75.1	255	do	do	White	1.05	.45	1.65	6.45	.318	13.76	13.13	5.29	6.13	11.41	46.36	2.66
13423	60.0	2.2	12.5	73.2	71.6	271	do	do	Slightly creamy	1.25	.54	1.50	6.46	.286	11.14	10.58	3.84	5.15	8.99	42.71	2.48
13425	59.7	1.6	12.3	73.5	72.4	266	do	do	White	1.16	.48	1.75	6.56	.368	10.80	9.75	3.41	5.03	8.44	40.40	2.30
13420	57.6	2.5	12.4	74.2	72.4	267	do	do	Slightly creamy	.95	.48	1.38	6.42	.240	10.27	9.68	3.44	4.93	8.37	41.10	2.64
13421	58.0	2.1	12.4	73.8	72.3	268	do	do	do	1.31	.60	1.46	6.55	.266	8.96	8.16	2.82	3.98	6.80	41.47	2.47
13424	57.8	1.4	12.5	72.1	71.1	273	do	do	do	1.16	.58	1.78	6.50	.318	11.97	11.37	4.23	5.73	9.96	42.47	2.50
13422	58.7	2.2	12.4	73.4	71.8	270	do	do	do	1.27	.56	1.70	6.54	.307	10.80	9.75	3.41	5.03	8.44	40.40	2.30
13426	58.0	3.3	12.0	73.6	71.2	271	do	Very soft	Creamy, white	1.03	.49	1.44	6.48	.265	8.16	7.50	2.74	3.30	6.04	45.36	2.72
13347	61.9	1.7	11.9	69.7	68.5	281	Semihard	Soft	White	1.72	.38	1.02	6.33	.177	7.34	6.18	2.29	2.76	6.18	45.35	2.99
14186	60.9	2.3	9.0	73.9	71.6	260	Very soft	Very soft	do	1.18	.45	1.43	6.73	.166	6.47	5.38	1.97	2.18	4.15	47.47	2.88
14307	63.8	1.9	11.5	70.7	69.4	276	Soft	Soft	do	1.21	.39	1.25	6.51	.179	7.24	6.57	2.10	2.85	4.95	42.42	2.38
13351	63.2	1.2	12.6	71.8	71.0	273	do	do	do	1.08	.40	1.19	6.49	.179	10.09	8.94	3.42	4.88	8.30	41.20	2.62
13350	62.9	.5	12.1	64.9	64.5	299	do	do	do	.88	.47	1.35	6.42	.250	12.88	12.05	4.24	6.49	10.73	39.52	2.39
13348	62.1	.6	12.9	71.2	70.8	275	do	do	do	1.28	.37	1.06	6.27	.185	9.60	8.43	3.13	4.16	7.29	42.94	2.45
13419[1]												1.30	6.38	.221	10.60						
13349	59.5	1.2	12.9	69.1	68.3	285	Soft	Soft	White	1.05	.47	1.08	6.41	.195	10.01	8.55	2.99	4.42	7.41	40.35	2.74
14567	63.0	1.3	10.8	74.5	73.6	258	Hard	Granular	do	.99	.44	1.31	6.59	.219	13.05	11.94	3.75	6.85	10.60	35.38	3.03
14566[1]												1.29	6.53	.255							
14568	60.4	2.4	10.9	72.8	71.1	268	Very hard	Granular	Creamy	1.27	.71	1.58	6.59	.311	16.21	14.90	5.25	7.84	13.09	40.11	3.78
14569	63.0	5.9	10.7	73.6	67.2	282	Semihard	Soft	Slightly creamy	1.44	.43	1.25	6.55	.214	10.57	9.73	3.40	4.91	8.31	40.91	2.88
14570	62.8	1.9	10.4	69.5	68.2	277	Soft	do	White	1.65	.42	1.25	6.65	.182	11.26	10.21	3.75	4.94	8.69	43.15	2.48
14572	63.3	2.1	10.8	75.7	74.1	257	do	do	do	1.14	.48	1.22	6.61	.214	11.89	10.06	3.96	4.69	8.75	45.26	2.96
14573	61.1	2.0	10.6	73.3	71.8	264	do	do	do	1.12	.46	1.29	6.60	.209	11.71	10.81	3.52	5.67	9.19	38.30	2.76
14574	62.5	1.1	10.8	77.5	76.6	248	do	do	do	.86	.42	1.23	6.68	.201	11.24	10.29	3.41	5.39	8.80	38.75	3.14
14575	61.7	1.5	10.6	74.2	73.2	259	do	do	do	1.37	.44	1.22	6.53	.219	12.67	11.79	3.97	6.22	10.19	38.96	2.29
14577	61.5	1.3	10.9	74.7	73.7	258	Semihard	do	Creamy	1.24	.59	1.49	6.62	.291	13.44	13.00	4.78	6.51	11.29	42.34	3.04
14571	61.0	1.9	10.7	77.8	76.3	249	Soft	do	White	1.17	.61	1.53	6.70	.290	8.09	7.13	2.32	3.48	5.80	40.00	2.61
14576	63.1	1.4	11.0	73.7	70.7	269	do	do	do	1.68	.47	1.17	6.58	.201	13.54	12.64	4.33	6.64	10.97	39.47	1.89

[1] Sample too small for milling purposes.

TABLE 132.—*Wheats grown in Australia: Baking properites of the variety samples described in Tables 130 and 131*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
13354	87	63	54.5	2,020	502	87	90	Fair	Creamy			289
13352	113	60	63.2	1,900	523	87	89	Good	do			301
13353	98	67	58.9	2,000	509	89	91	do	Light creamy			293
13355	101	65	54.3	2,060	496	88	91	Good, crumbly	Creamy			286
13356	92	64	60.5	1,920	520	88	91	Good, solid	do			300
13364	90	56	59.6	1,880	514	87	91	do	do			296
13423	96	64	56.0	2,080	506	89	92	Good	do			291
13425	93	60	55.5	1,930	502	89	92	Good, crumbly	do			289
13420	105	56	54.8	1,940	504	88	92	Excellent	Creamy, gray			291
13421	103	61	54.7	2,890	505	85	88	Good, crumbly	Very creamy			291
13424	98	58	56.9	1,970	509	87	83	do	do			293
13422	101	63	53.2	2,180	493	87	92	Good	Creamy			284
13426	91	57	54.3	1,800	499	86	86	Good, crumbly	Creamy, gray			288
13347	94	64	53.8	1,820	492	87	82	Fair, crumbly	Creamy			284
14186	87	63	49.4	1,690	476	89	82	do	do	Pale	Poor	275
14307	106	59	52.5	1,640	497	92	78	Poor, solid	do	do	do	287
13351	85	61	57.3	2,020	513	88	90	Good	do			296
13350	87	51	57.1	1,880	509	86	84	Poor, crumbly	do			293
13348	103	62	59.6	2,030	508	88	90	Excellent	do			293
13419[1]												
13349	89	59	57.4	1,950	511	87	88	Fair, crumbly	Creamy			295
14567	165	74	65.1	1,880	519	88	88	Fair, solid	do	Foxy brown	Fair	299
14566[1]				(1)								
14568	159	65	65.8	1,840	527	82	86	Good	Very, very creamy	Foxy brown	Poor	304
14569	131	69	53.9	1,910	489	87	92	Fair, solid	Creamy	Brown	Fair	282
14570	120	52	59.8	1,860	509	86	89	Good, crumbly	Light creamy	do	Poor	293
14572	128	64	61.9	1,870	509	87	89	Good	do	do	Fair	293
14573	128	62	60.4	1,910	509	86	88	Fair	Creamy	do	do	293
14574	126	72	59.5	1,800	506	86	88	Good	do	Light brown	Poor	291
14575	121	52	56.0	1,820	499	85	83	Fair	do	Foxy brown	do	288
14577	115	51	66.9	1,870	518	82	84	Fair, crumbly	do	Brown	do	299
14571	121	59	53.8	1,640	492	86	86	Poor, crumbly, solid	do	Very pale	Very poor	284
14576	112	47	55.8	1,610	491	78	70	Very poor, crumbly	Very creamy	Brown	do	283

[1] Not baked.

From a grading standpoint the wheats sent from New South Wales and Western Australia were of better quality than the wheats of South Australia, Tasmania, and Victoria.

From a milling standpoint, the order of merit was not the same: The wheats grown in Western Australia ranked first, followed in order by the wheats grown in New South Wales, South Australia, Tasmania, and Victoria.

The protein content of the Australian wheats varied from 6.47 to 16.21 per cent, the majority containing between 10 and 12 per cent. The wheats grown in Tasmania were noticeably low in protein.

As far as baking strength is concerned, all the Australian wheats, with the exception of those grown in Tasmania, produced flour of fairly good baking strength. A few exceptions are to be noted, namely, the varieties Braemar Velvet and Purple Straw, grown in Tasmania, and the varieties Clubhead and Yandilla King, grown in Western Australia.

With these four varieties eliminated from the averages, the average baking quality factors of the flour milled from the Australian wheats were as follows: Fermentation time, 109 minutes; proofing time, 61 minutes; water absorption of flour, 58.1 per cent; loaf volume, 1,926 cubic centimeters; weight of loaf, 507 grams; color score of crumb, 87; score of texture of crumb, 88; texture of crumb, good; shade of color of crumb, creamy; loaves of bread per barrel of flour, 293.

The milling quality of the Australian wheats appears to be a little stronger than that of the white wheats grown in the United States (Table 16) but not quite so good as that of the white wheats grown in India. (Table 119.)

From a baking standpoint, the quality of the flour milled from the Australian varieties is not quite equal to that of the white wheat flours of the United States. (Table 17, col. 5.) The Australian white wheat flours, however, are considerably stronger than the white wheat flours of Indian origin. (Table 120.)

AUSTRALIAN EXPORT WHEATS

Australia ranks fourth among those countries that export wheat, being outranked by Canada, the United States, and Argentina, in the order named. About one-fourth of the Australian wheat shipments are in the form of flour. Naturally, from the nature of the varieties grown, the export varieties are exclusively white wheat. Twelve cargoes of Australian export wheat were sampled through the courtesy of the Superintendence Co., and milling and baking tests were made upon the samples, in order to compare the quality of this export wheat with that of similar classes of wheat exported from other countries. From an examination of these samples, data for which are given in Tables 133, 134, and 135, it is apparent that the milling quality of Australian export wheat is of high quality. Weight per measured bushel is excellent, as is the yield of flour obtainable. The quantity of protein in the wheat and that in the resulting flour was the same as with the variety samples. Flour color, texture, and ash were typical of those of the varieties tested. The baking quality of the flour milled from the export cargo samples was uniform in character and of good quality.

TABLE 133.—*Australian export wheats: Ports of loading and unloading, and description and characteristics of samples taken at the port of unloading*

Laboratory No.	Port of loading	Port of unloading	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Per cent*	*Per cent*
14300	Fremantle, Western Australia	Hull, England	White	1 Hard White	0.7	88.0	61.0	0.0	0.2
13393	do	Rotterdam, Holland	do	do	.9	82.0	61.2	.0	.1
13754	Melbourne, Victoria	Hamburg, Germany	do	do	.5	94.0	61.4	.0	.2
14460	do	London, England	do	do	1.2	77.1	60.9	.6	.5
14482	do	do	do	do	1.1	80.9	60.0	.2	.4
13405	Port Pirie	Hamburg, Germany	do	do	.3	84.8	61.6	.0	.1
13391	Wallaroo, South Australia	Rotterdam, Holland	do	do	.6	80.2	60.2	.0	.4
13403	do	Hamburg, Germany	do	do	.9	94.4	61.1	.0	.1
14481	do	Hull, England	do	do	.9	80.2	60.3	.3	.4
14462	Adelaide, South Australia	London, England	do	2 Hard White	.8	84.7	59.5	.3	.2
14553	do	Hull, England	do	1 Soft White	.2	73.4	60.5	.0	.3
14554	do	London, England	do	do	.7	73.8	60.0	.0	.6
	Average		do	1 Hard White	.7	82.8	60.6	.1	.3

TABLE 134.—*Australian export wheats: Milling properties of the samples described in Table 133, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage-free wheat				Visual	Gasoline value		pH	Lactic acid			
	Pounds	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Pounds*					*Per cent*		*Per cent*	*Per cent*	*Per cent*	
14300	61.7	3.6	10.5	69.6	67.5	281	Soft	Soft	White	1.60	0.49	6.47	0.279	10.11	9.60	2.50
13393	60.5	3.6	12.3	75.2	73.5	264	do	do	do	1.20	.52	6.30	.189	10.32	9.51	2.80
13754	62.1	2.5	10.8	73.6	72.2	263	do	do	do	1.56	.47	6.19	.203	10.92	10.20	2.90
14460	61.3	3.2	10.8	73.1	71.6	265	do	do	do	1.61	.55	6.61	.205	9.50	8.63	2.71
14482	60.7	3.4	12.4	73.0	71.4	271	do	Very soft	do	1.56	.45	6.50	.242	9.94	8.81	2.36
13405	60.7	2.5	12.3	73.8	72.1	268	Semihard	Granular	Slightly creamy	1.51	.52	6.48	.208	10.60	9.72	2.35
13394	59.4	4.2	11.8	75.0	72.3	266	Soft	Soft	White	1.20	.51	6.17	.238	10.61	9.84	2.36
13403	59.9	4.1	11.9	74.1	71.7	278	do	do	do	.95	.50	6.48	.177	11.30	10.11	2.32
14481	61.1	2.6	11.4	73.6	72.7	263	do	do	do	1.58	.51	6.60	.221	10.63	9.76	2.44
14462	60.1	2.9	11.3	73.8	72.2	265	do	do	do	1.47	.63	6.64	.240	10.50	9.71	2.53
14553	61.0	2.9	12.3	71.7	70.1	276	do	Very soft	do	1.51	.40	6.64	.204	9.41	8.25	2.33
14554	60.5	2.4	12.1	72.4	71.2	271	do	Soft	Slightly creamy	1.69	.49	6.60	.223	9.40	7.71	2.26
Average	60.8	3.2	11.7	73.2	71.5	269	do	do	White	1.45	.50	6.47	.219	10.27	9.32	2.41

TABLE 135.—*Australian export wheats: Baking properties of the samples described in Tables 133 and 134*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
11300	106	64	53.2	1,970	492	86	82	Fair	Creamy	Brown	Fair	284
13393	115	53	56.4	1,830	506	87	90	Good	do			291
13751	114	60	57.6	2,040	504	88	82	Poor, crumbly	do	Brown	Fair	290
11460	124	64	53.3	1,840	490	87	86	Fair, crumbly	do	Pale	Poor	282
14182	110	58	55.0	2,130	497	85	88	Poor, crumbly	Very creamy	Light brown	do	276
13105	104	67	56.3	2,150	500	90	92	Good	Creamy			286
13394	111	58	54.6	2,000	503	86	88	Good, crumbly	do			290
13403	104	64	54.5	2,040	498	88	90	Good	do			287
14481	116	53	54.9	1,860	498	83	86	Poor, crumbly	Very creamy	Brown	Poor	276
14462	131	63	52.8	1,940	489	88	86	Fair, crumbly	Creamy	do	do	282
14553	134	66	55.5	2,010	493	86	91	Good	do	Pale	Fair	284
14554	131	67	54.1	1,980	491	85	89	do	do	do	do	283
Average	117	61	54.8	1,982	497	87	88	do	do	Light brown	Poor	286

A comparison of the relative milling and baking properties of the Australian export wheats of the 1926 crop and of the white wheat exported from the United States during the same crop year (average of two series of samples described in Tables 19 and 24), yields the following data: Under each item the value for the United States export wheats is given first. Dockage, 0.9 per cent, as compared with 0.7 per cent; test weight per bushel, 60.3 pounds, as compared with 60.6 pounds; kernel texture, 81.6 per cent, as compared with 82.8 per cent; damaged kernels, 0.3 per cent, as compared with 0.1 per cent; foreign material other than dockage, 0.4 per cent, as compared with 0.3 per cent; test weight per bushel of cleaned and scoured wheat (conditioned for milling), 60.6 pounds, as compared with 60.8 pounds; screenings and scourings removed (preparatory to milling), 3.6 per cent, as compared with 3.1 per cent; moisture in wheat before tempering, 10.7 per cent, as compared with 11.7 per cent; flour yields (1) basis cleaned and scoured wheat, 70.3 per cent, as compared with 73.2 per cent, (2) basis dockage-free wheat, 68.7 per cent, as compared with 71.5 per cent; wheat per barrel of flour (dockage-free wheat basis), 276 pounds, as compared with 268 pounds; crude protein in wheat, 10.96 per cent, as compared with 10.27 per cent; crude protein in flour, 9.83 per cent, as compared with 9.32 per cent; ash in flour, 0.51 per cent, as compared with 0.50 per cent; gluten quality coefficient, 2.28, as compared with 2.41; fermentation time of dough, 115 minutes, as compared with 117 minutes; water absorption of the flour, 54.7 per cent, as compared with 54.8 per cent; volume of loaf, 2,022 cubic centimeters, as compared with 1,983 cubic centimeters; weight of loaf, 495 grams, as compared with 497 grams; color score of crumb, 88, as compared with 87; texture score of crumb, 87, as compared with 88; bread per barrel of flour, 286 pounds in each instance.

NEW ZEALAND

Wheat production in New Zealand is gradually declining. From 1870 to 1891 there was a heavy increase in production, but with the inception of the more profitable frozen-meat and dairy industry, about 1890, wheat growing gradually declined, and during recent years the quantity of wheat produced has fed only two-thirds to three-fourths of the population. Heavy importations are now made from Australia and Canada.

Ninety-nine per cent of New Zealand's 8,000,000 bushels of wheat is grown in South Island. Of this, 90 per cent is grown on the east coastal plain (230 by 40 miles) embracing portions of the Provinces of Canterbury and Otago, and centering around the towns of Christchurch, Ashburton, Timaru, and Oamaru. Isolated areas of production, about 2,000 acres each, are found at Nelson and Blueheim in the north of South Island, and at six or seven points in the southeast part of Otago. One per cent of the total wheat crop is grown in North Island in two small sections near Wellington in the southern part of North Island. The coastal climatic and soil conditions are well suited to the growing of wheat. The remaining acreage in New Zealand is better adapted to grazing and the production of meats and dairy products.

TABLE 136.—*Wheats grown in New Zealand: Description and characteristics of the variety samples*

Laboratory No.	Province where grown	Variety	Predominating class	Grade	Dockage	Kernel texture	Test weight per bushel	Weight per 100 kernels	Damaged kernels	Foreign material other than dockage
					Per cent	*Per cent*	*Pounds*	*Grams*	*Per cent*	*Per cent*
[1] 14491	Canterbury	College Hunters	White	1 Soft White	0.5	8.5	[1] 0.3	4.3	0.2	.0
[1] 14492	do	College Velvet	do	do	.2	6.0	61.0	4.2	.5	0
[1] 14489	do	White Straw Tuscan	do	2 Soft White	.5	16.8	61.6	5.4	3.8	0
[1] 14490	do	Solid Straw Tuscan	do	3 Soft white	.6	12.9	61.1	5.2	4.4	0

[1] Crop year 1927.

TABLE 137.—*Wheats grown in New Zealand: Milling properties of the variety samples described in Table 136, and certain chemical constituents of the wheats and of the flour made from them*

Laboratory No.	Test weight per bushel	Screenings and scourings removed	Moisture of wheat before tempering	Flour yield—		Wheat per barrel of flour	Milling characteristics	Texture of flour	Color of flour		Ash in flour	Ash in wheat	Acidity of wheat as—		Crude protein in wheat	Crude protein in flour	Glutenin in flour	Gliadin in flour	Gluten protein in flour	Glutenin in gluten proteins	Gluten quality index (Gortner angle b)
				Basis cleaned and scoured wheat	Basis dockage free wheat				Visual	Gasoline value			pH	Lactic acid							
	Lbs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*					*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
14491	61.0	1.6	11.5	72.1	71.3	269	Soft	Very soft	White	1.33	0.51	1.68	6.65	0.266	8.19	7.19	2.46	3.51	5.97	41.21	2.29
14492	61.4	1.5	11.2	72.2	71.3	268	Semihard	Soft	do	.80	.46	1.49	6.62	.256	7.75	7.00	2.16	3.61	5.77	37.44	2.72
14489	62.0	2.5	11.3	71.3	69.9	274	Soft	do	do	1.25	.44	1.68	6.59	.266	7.70	6.43	2.07	3.37	5.44	38.05	2.73
14490	62.4	1.9	11.1	72.0	71.0	269	do	do	do	1.28	.50	1.58	6.60	.247	7.67	6.54	2.11	3.34	5.45	38.72	2.60

TABLE 138.—*Wheats grown in New Zealand: Baking properties of the variety samples described in Tables 136 and 137*

Laboratory No.	Fermentation time	Proofing time	Water absorption of flour	Volume of loaf	Weight of loaf	Color of crumb	Grain of crumb	Texture of crumb	Shade of color of crumb	Color of crust	Break and shred	Bread per barrel of flour
	Minutes	*Minutes*	*Per cent*	*C. c.*	*Grams*	*Score*	*Score*					*Pounds*
14491	98	68	51.7	1,730	488	86	84	Poor, crumbly	Creamy	Pale	Very poor	281
14492	108	63	56.0	1,530	498	89	82	do	Light creamy	do	do	287
14489	130	65	52.6	1,540	482	86	77	do	Creamy	Very pale	do	278
14490	107	59	53.7	1,480	493	84	78	do	do	Pale	do	284

Among the wheat varieties grown in New Zealand are Dreadnaught, Hunters, Major, Tuscan, Velvet, and Victor. The most widely grown varieties are Tuscan, Hunters, and Velvet. About 83 per cent of the total acreage is sown to Tuscan, 10 per cent to Hunters, and 5 per cent to Velvet. The production of Tuscan is increasing, and the production of Hunters and Velvet is decreasing.

Through the courtesy of C. J. Reakes, director general of the Department of Agriculture, at Wellington, New Zealand, samples of the varieties Hunters, Tuscan, and Velvet were obtained for milling and baking tests. According to Mr. Reakes, Hunters is a red wheat of winter habit and Velvet is a white wheat of winter habit. Solid straw Tuscan and white straw Tuscan are white wheats that may be sown in either the winter or the spring. Results of the milling and baking tests are given in Tables 136, 137, and 138.

From a milling standpoint all four varieties were of excellent quality, as they were of high test weight per bushel and yielded a high percentage of flour. The flour, however, was not of good baking quality, as its protein content was very low and the quality or strength of the gluten (protein), as indicated by the water absorption of the flour and the fermentation time of the dough, was below the average for the soft white class of wheat flours. Furthermore, the size and character of the finished loaf of bread was decidedly below normal in every instance except one. The size of the loaf was 25 per cent below the normal for soft white wheat flours, the texture of the loaf was coarse, and the color was creamy. The color of the crust indicated lack of sufficient diastatic activity.

SUMMARY

Milling and baking tests were made on samples of 412 varieties of wheat representative of the commercial types of wheat grown in 38 of the wheat-producing countries of the world, for the purpose of comparing their relative milling and baking qualities.

Similar tests were made upon samples of wheat representing 431 cargoes of export wheat, in order to determine the relative milling and baking properties of the wheat entering into international trade.

The more important milling and baking characteristics of these wheats are summarized in Table 139.

TABLE 139.—*Summary of the milling and baking qualities of the wheats analyzed*

Class of wheat and country where grown	Number of samples	Test weight per bushel	Flour yield	Wheat per barrel of flour	Crude protein in wheat	Crude protein in flour	Ash in flour	Color of flour	Fermentation time	Water absorption of flour	Volume of loaf	Color of crumb	Grain of crumb	Texture of crumb	Bread per barrel of flour
HARD RED SPRING															
		Pounds	*P. ct.*	*Pounds*	*P. ct.*	*P. ct.*	*P. ct.*		*Minutes*	*P. ct.*	*C. c.*	*Score*	*Score*		*Pounds*
Australia	2	[1] 61.0	[1] 73.6	258	13.05	11.94	0.44	White	165	65.1	1,880	88	88	Fair	299
Bulgaria	1	60.3	68.6	272	11.11	10.04	.66	do	112	53.4	1,870	78	84	do	281
Canada:															
Varieties	4	62.0	71.9	262	13.15	12.27	.53	do	134	59.1	2,068	85	79	do	294
Export	[3] 135	60.9	69.6	276	13.14	12.38	.48	Slightly creamy	141	60.9	2,110	87	89	Good	293
Czechoslovakia	1	61.8	76.3	248	12.18	11.66	.56	do	127	59.3	1,860	84	52	Poor	295
England	3	61.4	71.8	258	9.74	9.00	.50	do	98	52.2	1,600	76	60	Fair	285
Estonia	3	60.5	70.2	259	11.04	10.42	.60	White	130	59.6	1,793	82	72	do	295
Germany	2	57.6	70.8	271	13.79	12.54	.55	do	140	64.1	1,870	86	88	do	295
Hungary	1	60.5	67.4	280	12.25	11.01	.61	do	134	57.8	2,000	81	76	Good	293
India	1	60.9	73.7	260	13.97	12.69	.55	Slightly creamy	133	61.6	2,390	91	93	do	288
Japan	4	58.8	66.6	288	11.43	10.26	.46	White	112	53.8	1,868	86	65	Poor	284
Latvia	2	58.7	69.6	272	9.76	8.48	.48	Slightly creamy	120	55.4	1,750	77	78	do	286
Netherlands	1	59.8	70.9	267	10.18	9.28	.47	White	89	54.5	1,640	72	34	do	288
Norway	5	61.7	70.7	272	10.84	9.89	.62	Slightly creamy	154	60.5	1,690	77	75	do	296
Poland	1	60.3	67.6	278	13.02	12.93	.56	White	127	51.6	1,940	74	71	do	279
Russia	5	57.4	66.9	284	14.51	13.48	.57	do	129	56.5	2,166	80	69	Fair	288
Sweden:															
Varieties	3	61.0	72.2	267	9.39	8.33	.55	do	153	57.7	1,797	82	84	Poor	288
Export	1	59.4	67.5	285	10.00	8.50	.41	do	112	55.1	1,780	78	77	do	286
Switzerland	1	59.1	69.5	269	12.65	11.87	.60	do	110	55.8	1,890	80	66	Fair	290
Union of South Africa	5	62.3	69.4	276	11.05	10.26	.55	do	137	63.5	1,828	81	81	Poor	296
United States:															
Varieties	14	58.2	69.0	278	16.10	15.32	.53	Slightly creamy	156	61.8	2,291	86	92	Very good	294
Export	15	59.5	68.8	277	12.77	11.98	.50	do	147	58.3	2,162	87	91	Good	289
Uruguay	4	61.3	70.8	270	11.53	10.56	.49	White	152	58.6	1,958	88	91	Fair	289
DURUM															
Argentina	1	58.9	66.9	288	10.65	9.63	.64	Very creamy	147	60.3	1,680	80	86	Good	295
Australia	1	60.1	71.1	268	16.21	14.90	.71	Slightly creamy	159	65.8	1,840	82	86	do	304
Bulgaria	2	57.8	66.8	278	12.06	11.57	.83	Creamy	140	61.9	1,870	84	90	Excellent	294
Canada:															
Varieties	2	61.4	73.0	258	14.44	14.04	.79	do	138	61.4	1,985	83	85	Good	298
Export	2	62.0	71.2	268	11.76	11.32	.66	do	130	59.4	2,010	84	90	Very good	292
Greece	3	59.1	70.2	271	11.62	10.54	.78	do	135	61.8	1,543	70	59	Poor	296
India	2	60.8	72.6	259	10.00	9.22	.82	do	164	65.0	1,675	78	80	Fair	297
Iraq	3	57.6	65.4	289	10.42	9.65	.84	Slightly creamy	129	63.2	1,550	83	62	do	304

[1] Average of 2 samples.

[2] *Figures for only 1 sample.*

[3] Weighted averages for export spring wheat carrying Canadian grade designations. (Table 10.)

TABLE 139.—*Summary of the milling and baking qualities of the wheats analyzed*—Continued

Class of wheat and country where grown	Number of samples	Test weight per bushel	Flour yield	Wheat per barrel of flour	Crude protein in wheat	Crude protein in flour	Ash in flour	Color of flour	Fermentation time	Water absorption of flour	Volume of loaf	Color of crumb	Grain of crumb	Texture of crumb	Bread per barrel of flour
DURUM—continued		*Pounds*	*P. ct.*	*Pounds*	*P. ct.*	*P. ct.*	*P. ct.*		*Minutes*	*P. ct.*	*C. c.*	*Score*	*Score*		*Pounds*
Italy	3	61.2	68.8	275	11.41	10.57	0.85	Creamy	121	64.8	1,620	75	57	Fair	305
Latvia	1	62.3	73.8	255	10.34	9.55	.73	do	151	57.7	2,010	80	90	Good	291
Morocco	1	63.4	69.7	277	12.38	11.82	.81	Very creamy	142	65.6	1,560	83	80	Fair	303
Palestine	2	61.2	68.2	274	12.42	12.02	.86	Creamy	136	65.4	1,615	79	62	Poor	304
Poland	1	62.1	71.0	265	10.86	10.13	.86	do	146	58.8	1,650	82	90	Fair	291
Portugal	1	60.6	66.7	280	9.68	9.09	.77	do	146	63.7	1,470	80	72	Poor	302
Russia	13	60.0	69.5	273	15.28	14.75	.80	do	140	62.7	2,142	89	89	Excellent	299
Spain	1	61.5	69.2	272	10.80	10.49	.99	do	130	68.6	1,380	78	34	Poor	313
Tunis	3	61.9	70.3	271	10.77	10.03	.85	do	121	63.2	1,393	81	22	do	305
United States:															
Varieties	5	60.3	71.0	270	15.34	14.76	.75	do	145	63.9	1,956	84	90	Very good	298
Export	11	61.1	70.4	274	12.02	11.27	.67	do	136	60.7	2,029	84	89	do	295
Uruguay	3	60.9	70.0	274	12.73	12.39	.85	do	158	68.0	1,777	84	86	Fair	303
HARD RED WINTER															
Argentina:															
Varieties	7	60.7	69.5	278	12.63	11.71	.45	White	130	59.3	2,016	90	91	Good	294
Export (1926	31	56.1	64.5	298	11.00	10.07	.49	Slightly creamy	127	55.8	2,187	87	91	do	286
Export 1927	16	59.4	67.9	283	11.72	10.81	.51	White	148	56.2	2,159	88	90	Very good	284
Australia	1	63.1	71.0	273	10.09	8.94	.40	do	85	57.3	2,020	88	90	Good	295
Bulgaria	1	59.5	71.0	263	10.49	9.16	.41	do	112	52.2	1,990	89	90	do	277
Canada	1	63.4	72.5	259	14.45	13.50	.53	do	138	58.7	1,950	83	78	Poor	296
Czechoslovakia	1	62.4	73.1	260	10.08	9.29	.52	Slightly creamy	97	54.8	1,620	79	42	do	288
Hungary	1	59.7	71.8	265	10.52	9.87	.49	White	120	56.6	1,910	87	80	Fair	289
India	1	62.1	74.2	256	9.97	9.37	.64	do	161	61.5	1,760	88	76	do	296
Russia	11	60.5	72.3	265	13.00	12.25	.54	Slightly creamy	142	57.7	1,963	81	65	do	289
United States:															
Varieties	15	58.9	70.1	274	14.44	13.68	.48	do	146	61.3	2,207	86	90	Good	295
Export	67	60.1	70.0	271	10.87	9.96	.52	White	138	58.0	2,145	87	91	do	289
Uruguay: Export	1	55.6	65.3	297	11.12	10.30	.52	do	135	56.1	2,270	87	91	do	285
SOFT RED WINTER															
Argentina	4	60.4	70.2	276	10.82	10.02	.45	do	128	58.5	1,950	90	89	do	293
Australia	2	62.8	67.8	284	11.54	10.66	.44	do	87	55.8	1,900	86	87	Fair	291
Belgium	3	58.6	69.0	273	9.09	8.21	.52	do	130	56.2	1,623	85	78	Very poor	286
Bulgaria	3	57.4	67.3	277	9.54	8.37	.52	do	117	50.7	1,940	81	87	Fair	277
Chile: Export	1	59.6	69.8	269	10.66	9.91	.41	do	118	56.8	2,080	91	90	Very good	297
Denmark	2	58.1	70.1	278	9.07	8.16	.45	do	105	52.4	1,570	84	45	Poor	283
England	10	60.5	70.1	270	9.45	8.39	.51	do	100	53.0	1,613	81	54	do	285

Germany:														
Varieties	4	57.2	69.6	273	9.68	8.57	.51	Slightly creamy	133	54.6	1,755	82	79	Very poor	282
Export	6	57.2	69.3	273	10.18	9.32	.51	White	108	52.2	1,710	77	54	Poor	285
Hungary	2	60.0	71.5	261	10.37	9.09	.48	do	114	54.9	1,755	80	73	Good	286
India	4	62.3	71.5	264	9.74	8.79	.56	Slightly creamy	131	62.5	1,630	76	70	Poor	296
Ireland	6	60.0	68.3	278	8.68	8.04	.48	White	109	54.4	1,708	83	79	do	284
Italy	23	58.2	69.3	275	11.18	10.16	.50	do	106	53.0	1,769	81	54	do	285
Japan	3	60.5	[4] 68.8	[4] 282	[4] 9.96	[4] 8.90	[4] .46	Slightly creamy [4]	[4] 124	[4] 55.6	[4] 1,895	[4] 84	[4] 79	do [4]	[4] 288
Latvia	2	58.4	69.8	269	11.09	9.88	.44	Slightly creamy	111	55.0	1,895	82	86	Fair	286
Lithuania	2	60.8	67.6	284	11.37	10.40	.41	White	107	54.8	1,900	88	58	do	293
Mexico	6	58.5	70.2	275	9.00	8.56	.46	do	111	54.0	1,902	84	85	do	287
Netherlands	1	57.9	70.8	265	8.03	7.44	.54	do	94	51.3	1,880	74	32	Poor	281
Portugal	1	61.8	66.1	281	9.86	8.87	.49	do	115	50.9	1,840	86	83	Good	277
Russia	9	58.2	68.4	277	12.44	11.30	.57	Slightly creamy	110	54.0	2,006	80	65	Fair	285
Scotland	4	59.0	69.5	272	8.62	7.41	.57	White	99	53.4	1,805	67	58	do	286
Spain	2	59.8	70.0	268	9.16	8.28	.53	Creamy	93	52.8	1,765	84	70	Fair	282
Sweden:														
Varieties	3	58.5	69.1	279	10.02	8.98	.50	Slightly creamy	116	53.7	1,850	77	71	Very poor	281
Export	1	57.8	70.5	276	8.60	7.50	.50	do	101	54.5	1,870	83	48	Poor	285
Switzerland	8	60.4	70.3	269	10.52	9.78	.52	do	106	54.7	1,842	76	38	do	288
Union of South Africa	3	62.0	69.8	275	9.74	8.95	.52	White	141	56.3	1,770	82	81	do	287
United States:														
Varieties	9	59.0	68.6	278	14.25	13.03	.45	Slightly creamy	112	55.4	2,134	87	90	Good	287
Export	63	59.9	68.8	276	10.24	9.15	.48	White	114	53.5	2,133	88	88	Fair	282
WHITE														
Argentina	1	59.2	71.8	269	8.30	7.59	.55	do	118	57.9	1,600	87	82	do	294
Australia:														
Varieties	27	61.0	[5] 71.3	[5] 269	[5] 10.41	[5] 9.54	[5] .48	Slightly creamy [5]	[5] 106	[5] 57.0	[5] 1,883	[5] 87	[5] 87	Good [5]	[5] 290
Export	12	60.6	71.5	269	10.27	9.32	.50	White	117	54.8	1,982	87	88	Good	286
Belgium	3	58.4	69.2	271	8.64	7.52	.54	do	122	55.1	1,593	82	75	Very poor	282
Bulgaria	1	59.3	67.7	274	12.15	10.39	.43	do	129	49.4	2,340	88	92	Good	275
Canada:														
Varieties	3	60.3	70.9	266	9.68	8.76	.51	do	109	54.3	1,773	87	62	do	289
Export	2	59.3	68.3	279	12.10	11.20	.56	do	114	55.8	2,115	90	90	Fair	286
Chile:														
Varieties	4	61.8	71.9	270	8.62	7.72	.53	do	105	56.7	1,840	87	72	do	287
Export	1	59.6	69.3	276	9.01	8.03	.42	do	128	51.9	1,970	40	89	Good	283
Denmark	1	58.8	71.1	278	8.51	7.14	.40	do	105	52.0	1,730	85	41	Poor	282
Egypt	4	63.1	71.2	268	9.06	8.36	.64	do	113	57.8	1,620	84	62	do	292
England	3	60.6	70.9	266	8.95	8.02	.45	do	94	52.1	1,557	84	37	do	283
Estonia	1	61.0	72.0	261	12.50	12.04	.57	do	111	56.8	1,630	83	16	Very poor	291
Greece	1	57.1	69.5	273	12.13	10.98	.47	do	136	54.4	1,880	86	86	Poor	286
India	21	62.5	73.2	257	10.17	9.41	.64	Slightly creamy	144	64.6	1,711	82	77	do	299
Iraq	6	61.1	70.5	268	9.62	8.78	.50	White	108	59.1	1,747	86	71	do	296
Ireland	1	57.1	63.6	295	6.93	5.73	.51	do	100	53.1	1,710	85	68	do	284
Italy	3	58.0	70.0	271	10.25	9.50	.48	do	107	52.2	1,727	85	70	do	282
Japan	2	62.0	73.8	257	11.12	10.25	.56	do	107	52.7	1,710	78	36	do	286
Lithuania	2	60.6	73.0	262	11.20	10.91	.48	Creamy	100	54.8	1,730	79	50	do	286
Mexico	15	59.0	69.7	275	10.43	9.23	.49	Slightly creamy	106	54.1	2,096	86	89	Fair	286

[4] Average of 2 samples.

[5] Average of 26 samples.

TABLE 139.—*Summary of the milling and baking qualities of the wheats analyzed*—Continued

Class of wheat and country where grown	Number of samples	Test weight per bushel	Flour yield	Wheat per barrel of flour	Crude protein in wheat	Crude protein in flour	Ash in flour	Color of flour	Fermentation time	Water absorption of flour	Volume of loaf	Color of crumb	Grain of crumb	Texture of crumb	Bread per barrel of flour
WHITE—continued		*Pounds*	*P. ct.*	*Pounds*	*P. ct.*	*P. ct.*	*P. ct.*		*Minutes*	*P. ct.*	*C. c.*	*Score*	*Score*		*Pounds*
Morocco	1	61.9	70.1	275	12.50	12.05	0.60	White	117	55.8	1,790	83	82	Fair	292
Netherlands	5	58.2	70.2	270	9.94	8.98	.50	do	100	52.1	1,662	75	32	Poor	282
New Zealand	4	61.0	70.9	270	7.83	6.79	.48	do	111	53.5	1,570	86	80	Very poor	282
Poland	1	60.6	69.6	273	10.05	9.01	.41	Slightly creamy	124	53.6	1,840	84	90	Good	283
Russia	2	59.6	72.6	264	10.64	9.85	.56	Creamy	126	56.4	2,105	83	88	do	287
Scotland	2	59.6	71.6	262	8.68	7.92	.57	White	94	52.4	1,525	75	58	Poor	285
Spain	2	61.6	71.8	262	9.69	9.03	.50	Creamy	105	52.5	1,730	74	42	do	284
Sweden	1	56.3	69.2	280	8.32	6.89	.49	White	118	52.4	1,620	72	70	Very poor	278
Tunis	5	60.5	70.7	269	11.39	10.63	.50	do	109	54.6	1,794	87	71	Fair	288
Union of South Africa	5	62.1	71.6	268	10.93	10.23	.53	do	141	59.8	1,810	81	78	Poor	291
United States:															
Varieties	11	57.5	69.3	275	13.11	12.76	.50	do	122	59.1	2,142	88	91	Good	292
Export	46	60.5	68.8	276	10.96	9.81	.51	do	115	54.7	2,038	88	87	Fair	285
POULARD (*T. Turgidum* L.)															
Egypt	5	59.5	67.7	282	9.53	8.52	.74	Creamy	120	59.2	1,174	71	9	Poor	295
India	1	59.2	68.2	277	12.48	11.29	.90	White	161	62.8	1,770	54	62	do	295
Italy	2	56.6	67.8	283	8.44	7.53	.76	Slightly creamy	116	57.5	1,340	82	18	Very poor	292
Palestine	1	62.2	69.4	269	12.21	12.00	.89	Creamy, yellow	129	64.1	1,690	82	80	Poor	310
Portugal	1	57.0	65.1	287	8.44	7.36	.63	Creamy	149	51.9	1,650	87	88	do	285
POLISH WHEAT (*T. polonicum* L.)															
Italy	1	57.1	66.9	285	11.79	11.03	.94	do	132	64.0	1,530	82	44	Fair	309

Detailed figures regarding the commercial classification of these wheats, their milling and baking properties, and statistics concerning the production, distribution, and consumption of wheat have been given in connection with each country.

As a result of the study it is apparent that the majority of the wheats grown throughout the world are of the common type (*Triticum vulgare*). Wheat similar to the spring wheats produced in the United States is grown in Australia, Bulgaria, Canada, Czechoslovakia, England, Estonia, Germany, Hungary, India, Japan, Latvia, Manchuria, Norway, Russia, Sweden, Switzerland, the Netherlands, the Union of South Africa, and Uruguay. By far the greatest production of hard red spring wheat occurs in Canada, with Russia and the United States ranking next in order. Hard red spring wheats are grown in Australia, England, India, Switzerland, the Netherlands, and Uruguay, but their production is relatively unimportant.

Large acreages are devoted to the production of durum wheat in Algeria, Bulgaria, Canada, Greece, Iraq, Italy, Morocco, Palestine, Russia, and Tunis. Although durum wheat is raised in Argentina, Australia, India, Latvia, and Uruguay, it is relatively unimportant. Rumania and Yugoslavia also grow durum wheat, but no samples were received from those countries for testing.

Only eight countries sent wheat similar in appearance to the hard red winter wheats grown in the United States. Of these Russia probably produces the greatest quantity, followed in order by the United States and Argentina. Smaller quantities are grown in Canada, Czechoslovakia, and Hungary. Although hard red winter wheats are grown in Australia, Bulgaria, and India, the quantity is very small in each instance, and there seems to be little likelihood of increase.

Soft red winter wheats were received from Argentina, Australia, Belgium, Bulgaria, Chile, Denmark, England, Germany, Hungary, India, Ireland, Italy, Japan, Latvia, Lithuania, Mexico, Portugal, Russia, Scotland, Spain, Sweden, Switzerland, the Netherlands, the Union of South Africa, and the United States. They are outstandingly important commercially in Belgium, the lower Danube countries of Rumania, and Yugoslavia, Bulgaria, Denmark, England, France, Germany, Hungary, Ireland, Italy, Japan, Latvia, Portugal, Russia, Scotland, Spain, Switzerland, the Union of South Africa, and the United States.

Twenty-nine of the thirty-eight countries that contributed wheat to this study produce white wheat. The countries in which white wheat is of large commercial importance are Australia, Belgium, China, Chile, Egypt, England, Estonia, India, Iraq, Japan, Lithuania, Mexico, Morocco, New Zealand, Poland, Scotland, Spain, the Netherlands, the Union of South Africa, Tunis, and the United States. White wheat is reported as being produced in small quantities in Algeria, Argentina, Bulgaria, Canada, Greece, Ireland, and Italy. By far the greatest production of white wheat takes place in India, with Australia second and the United States third. With the exception of Spain and China for which statistics on class production are not available, all the other countries produce less than 25,000,000 bushels of white wheat annually.

It is concluded from a study of the milling and baking data resulting from the analysis of the world's wheat that while milling quality, that is, the ability to produce a large quantity of high-grade flour from the minimum quantity of wheat, is a factor in determining the

relative standing of quality of the wheats, it is the baking quality of the flours milled from these wheats that sharply differentiates the wheats.

As far as the hard red spring wheats are concerned, the higher grades of Canadian wheat rank first in milling value. However, from a baking standpoint the flours milled from the hard red spring wheats grown in the United States are equally good. Russian spring wheats appear to be somewhat deficient in baking strength when compared with those grown in North America and South America.

The spring wheats grown in northern Europe—in Norway, Sweden, Germany, Latvia, and Poland—although in most instances of good milling value, are somewhat deficient in baking strength. This is also true of the spring wheats grown in the Union of South Africa. Uruguay, on the other hand, produces spring wheat of very good baking strength.

Russia, Canada, and the United States produce the best quality of durum wheat. All the other countries producing durum wheat, with but minor exceptions, have a product that is very noticeably deficient in baking strength.

From both a milling and a baking standpoint, the best quality hard red winter wheat is produced in the United States. The hard red winter wheat grown in Argentina appears to be of lesser milling value than that grown in the United States. The baking quality of the flour milled from Argentine wheat, although not the equal of that milled from the hard red winter wheats of the United States, is of fair quality. The flour milled from the Russian hard red winter wheats appears to be lacking in baking strength. Those of Bulgaria and Hungary do not appear to be quite so strong as the Argentine wheats of similar classification.

The soft red winter wheats grown in the United States, although failing to equal the milling quality of some wheats of the same class grown in other parts of the world, excelled in baking quality in every instance. Those produced in the United Kingdom as well as those produced in the greater part of continental Europe are of average, to above-average milling quality, but are decidedly deficient in baking quality. Only in European Russia, Hungary, and the lower Danube countries are found soft red winter wheats that have fair-to-average baking qualities as well as milling quality.

The white wheats grown in India, Australia, and the United States rank in milling quality in the order in which the countries are named. From a baking standpoint, the flours milled from the white wheats produced in the United States and Australia are of approximately the same strength; the baking strength of the flours milled from the white wheats of India is noticeably less. Mexico, Russia, Poland, Chile, Morocco, and the Union of South Africa also produce white wheat of good baking strength. Those grown in all other parts of the world are much below average in this respect.

In the warm and dry areas of southern Europe and Asia, and northern Africa, poulard wheat (*Triticum turgidum*) is popular. Milling and baking tests were made on this class of wheat on samples submitted from Egypt, Italy, Palestine, Portugal, and India, and the results were always below the average of any of the other classes of wheat studied.

It is recognized that, because of the changes in environmental conditions which control the production of wheat from year to year, observations as to the quality of any given crop should not be considered as final, and that fairer conclusions might be drawn if the data were the result of the study of samples of the crops of several years. Nevertheless, considering the difficulty encountered in obtaining the samples for this testing, a continued study was deemed impracticable. One point in favor of the conclusions to be drawn from this study is that, with one or two exceptions, the information that accompanied the samples sent from the various countries was to the effect that the wheats were grown in an average crop year. Moreover, the baking properties of the wheats produced in the majority of the countries were so widely different that the differences can hardly be attributable in any significant degree to annual variation in the sample characteristics. Therefore a study continued over a series of years seems unlikely to prove more useful than this study of the samples of one crop year.

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