UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

DEPARTMENTS OF CHEMISTRY AND HOME ECONOMICS

DRY-FARMED AND IRRIGATED WHEAT

BULLETIN NO. 88 MAY, 1916

Published by the University of Idaho, Moscow

SUMMARY

This report on dry-farmed and irrigated wheat covers a completed portion of a general investigation which was commenced in 1907 and which has for its ultimate object the determination of factors which determine the protein content of normally matured wheat. Gluten is the most important constituent of wheat flour because it makes possible the baking of light bread. The gluten content of flour depends upon the protein content of wheat from which it was ground and, altho flours may vary rather widely in the percentage content of gluten without varying to the same extent in baking value, a reasonable percentage of gluten is absolutely necessary to insure satisfactory results under normal conditions of baking.

There is a widespread feeling among investigators, grain buyers and millers that the maintenance of quality in wheat depends primarily upon the maintenance of a high protein content and that the improvement of northwestern grown wheat in some way is intimately connected with a substantial increase of that constituent in the commonly grown varieties. At any rate those wheats which establish the standards of excellence in milling centers are relatively high in protein and produce flours of relatively high gluten content. Finally, experience teaches that no matter what other objects the wheat breeder may attain, they are for practical purposes almost valueless if in their attainment protein content is materially sacrificed. All of this is mentioned to emphasize the importance of any series of investigations which seeks to ascertain, in order that they may be controlled, those factors which cover the manufacture in the wheat plant of protein and its storage in the matured grain.

When this series of investigations was undertaken, we knew in a general way only the rating which wheat grown in the Pacific Northwest ought to be given in competition with the other wheat growing districts. The extremely varied conditions under which the crop is grown in the northwest could not escape notice. Whether or not quality could be correlated in any marked degree with such differences appears to be ascertainable only by the systematic collection of samples thru a term of years, and the performance of the necessary analytical work and baking tests. The first report was made in 1911. This one is supplementary to a certain extent but deals specifically with wheat grown in south Idaho under two radical differed systems of farming—dry-farming and irrigation. The samples reported upon were grown and secured for analytical, milling and baking tests in 1912, 1913 and 1914.

Examination of the data secured suggests that possibly some varieties of wheat respond more quickly to changes of environment than do others. This seems to be particularly true of Turkey Red and Marquis. Nevertheless the protein of the average dry-farmed sample was only one percent greater and the protein of its flour only seven-tenths percent greater than that of the average irrigated sample—differences too small to be strongly reflected in the gluten percentage either wet or dry. There were no significant differences between the average dry--farmed and irrigated sample in weight per bushel, in weight per 1000 kernels or in percentage of moisture, ash and oil.

Results of baking tests in many ways do not support the commonly held views regarding the relative values for bread making purposes of dry-farmed and irrigated wheats. They suggest the possibility of making greater progress toward the raising of flour standards in this state by a systematic insistence on the part of housewives for brands of flour that have been ground from the better varieties of wheat rather than by discrimination in favor of either the dry-farmed or the irrigated product.

DRY-FARMED AND IRRIGATED WHEAT.

By J. S. Jones and C. W. Colver

In every wheat-growing district certain factors of soil and climate combine to affect favorably or unfavorably the quality of its wheat for milling purposes. It is extremely doubtful, however, if the mode of operation of any specific factor or set of factors in making for or against high milling values is at this time thoroly understood. A better understanding of the many points involved is of especial importance to growers and mill-men of the Inter-Mountain and Pacific Coast states where common experience teaches that a great deal of the wheat produced is not all that is desirable for milling purposes. With this view of the situation, we began several years ago an investigation which has for its ultimate object the determination as nearly as may be of the specific influence of the several factors which operate in Idaho to raise or lower the milling value of her wheat crop. Not until the influence upon quality of such soil factors as moisture, texture, bacterial activity, alkalinity, and acidity, and of such climatical factors as temperature, humidity, and sunshine shall have been determined will one be justified in stating whether desired improvement of quality thruout the state is or is not a practicable possibility. At the present time it would seem from data secured from the experience of the past several years that soil factors, especially those concerned in the production of the more readily available nitrogen compounds are not nearly so negligible in determining what shall be the quality of the grain produced as in some quarters is commonly supposed. This phase of our work, however, will be discussed in a subsequent publication. The work presented here is of indirect value only in solving the main problem.

When the experimental work which seeks to determine the influence upon quality of the factors mentioned above was undertaken, we knew in a general way only the rating which Idaho wheat ought to be given in competition with milling wheats from other wheat-growing districts. The extremely varied conditions under which the crop is grown in the several sections of the state could not escape notice. Whether or not quality could be correlated in any marked degree with such differences appeared to be ascertainable only by the systematic collection of samples thru a term of years and the performance of the necessary analytical work and baking tests. Three years of such work lead to the conclusion that north-Idaho-grown wheat and the irrigated south-Idaho-grown wheat are practically of the same value for milling purposes. Dry-farmed wheat appeared from the same work to be somewhat superior to either. Several considerations, more particularly the rapidly extending area brought under cultivation by the dry-farmer and the growing tendency of grain men to discriminate between irrigated and dry-farmed wheat and the belief that it would be of some assistance in the solution of the general problem under investigation, induced the undertaking of additional work of a similar nature confined entirely to the dry-farmed

and irrigated product. The samples secured for milling and analytical work are representative of the crops of 1912, 1913 and 1914. This bulletin will present the results of the work done upon them and the conclusions those results seem to justify.

As pointed out in bulletin No. 72, wheat growing with irrigation or under dry-farm methods is confined to the extreme southeastern counties and the great valley of the Snake river in south Idaho where elevations range from 2000 to 5000 feet. A few shipping points receive the irrigated product only but the greater number receive and ship both irrigated and dry-farmed wheat for above the high line canals in any section where the annual rainfall exceeds twelve inches the dry-farmer has ventured to turn over the sage brush land for wheat cropping purposes. His yields of course are not always satisfactory but the increasing acreage of dry-farmed land testifies in a general way at least to the success of his venture. In those sections where rainfall exceeds fifteen inches or where seepage from late melting snows on adjacent foot hills materially supplements the annual precipitation, dry-farming is firmly established.

No pronounced differences in soil distinguish the irrigated from the dry-farmed sections when they are first put under cultivation. The soils of both sections vary in texture with locality but sandy loams and silt loams predominate. Their low content of humus is characteristic. When put under irrigation wheat quickly comes into a fairly definite rotation with alfalfa and the root crops—a rotation that tends to overcome the soil's native deficiency in organic matter. The dry-farmer is forced to practice the summer-fallow system and is less fortunate in having at hand convenient means for increasing his soil's content of organic matter. The growing of wheat in rotation with some such crop as alfalfa, sweet clover, or peas in cultivated rows may be the means of solving this difficulty for him.

On the irrigated and smaller dry-farms, the self-binder is the harvesting machine. On the larger dry-farms, combined harvesters are generally used. Both elevators and warehouses receive the grain for storage and shipment. It is doubtful if differences in methods of harvesting or differences of conditions under which the grain is stored play more than a minor part in determining milling values.

Previous experience had taught us the futility of expecting to secure samples of many varieties grown under both dry-farmed and irrigated conditions. Turkey Red is by far the most widely grown dry-farm wheat but Gold Coin and Winter Fife are still favored varieties in some sections. Bluestem, Defiance, and Dicklow are perhaps grown more generally than other varieties under irrigation. Samples of approximately 100 pounds each were secured of the grower himself when possible, otherwise from mill and elevator men who gave no little encouragement to the work. Districts represented by both dry-farmed and irrigated samples are Abereen, Ashton, Gooding, Idaho Falls, Menan, Midvale, Richfield, and St. Anthony. Districts represented by dry-farmed samples only are American Falls, Cambridge, Dayton, Driggs,

Drummond, Glendale, Malad, Montpelier, Riverdale, Weiser and Weston. Districts represented by irrigated samples only are Boise, Buhl, Caldwell, Meridian, Twin Falls and Sugar City.

A small roller mill fully described in bulletin No. 72 was used for the grinding; table No. 1 indicates with what results from the standpoint of yields in bran, shorts and flour.*

Table No. I—Mill Products

Year	Variety and How Grown	No. of Samples	Bran Percent.	Shorts Percent.	Flour Percent.	Gain or Loss in Milling Percent.
1912	Bluestem D. F.	3	13.25	20.46	65.67	— .62
1913	" "	4	13.27	17.56	68.83	— .34
1914	" "	5	12.32	17.94	68.72	—1.02
	Average	12	12.87	18.45	67.99	— .69
1912	Bluestem Irr.	2	9.56	25.12	64.53	— .79
1913	" "	2	12.20	18.17	68.19	+1.44
1914	" "	4	14.02	15.36	70.17	— .45
	Average	8	12.45	18.51	68.26	— .78
1912	Bluestem (Haynes) Irr.	1	10.67	18.66	70.67	
1913	" " "	1	10.17	16.95	79.66	+6.78
	Average	2	10.42	17.80	75.17	+3.39
1912	California Club Irr.	1	24.52	11.30	62.50	+1.68
1913	Canadian Hybrid D. F.	1	10.36	17.86	76.07	+4.29
1914	" " "	1	10.97	16.14	72.24	— .65
	Average	2	10.67	17.00	74.15	+1.82
1914	College Hybrid Irr.	1	15.87	17.46	61.90	—4.77
1913	Colorado No. 50 D. F.	1	13.98	17.37	67.37	—1.28
1914	" " "	1	15.26	17.79	74.58	+7.63
	Average	2	14.62	17.58	70.98	+3.18
1913	Dago Irr.	1	10.64	16.60	75.74	+2.98
1912	Defiance Irr.	3	13.88	20.01	64.96	—1.15
1913	" "	4	13.44	15.20	73.80	+2.44
1914	" "	3	10.70	15.99	76.00	+2.69
	Average	10	12.75	16.88	71.81	+1.44
1912	Dicklow Irr.	4	11.87	17.80	71.21	+ .88
1913	" "	4	16.14	15.23	68.81	+ .18
1914	" "	5	14.60	15.66	68.99	— .75
	Average	13	14.23	16.19	69.62	+ .04
1913	Fife D. F.	1	16.95	16.53	66.95	+ .43
1913	" "	1	12.50	14.17	75.00	+1.67
	Average	2	14.72	15.35	70.98	+1.05

*In this and subsequent tables average results only are presented.

Table No. I—(Continued)—Mill Products

Year	Variety and How Grown	No. of Samples	Bran Percent.	Shorts Percent.	Flour Percent.	Gain or Loss in Milling Percent.
1913	Forty Fold D. F.	1	16.25	22.92	62.91	+2.08
1914	" "	1	9.28	16.43	74.29	
	Average	2	12.77	19.67	68.60	+1.08
1914	Fultz D. F.	1	16.67	15.00	66.67	—1.66
1912	Gold Coin D. F.	2	15.58	13.44	72.87	+1.89
1913	" " "	3	13.01	18.02	69.69	+ .72
1914	" " "	8	13.23	17.75	70.74	+1.72
	Average	13	13.54	17.15	70.83	+1.52
1913	Galgalos Irr.	1	14.41	14.40	71.19	
1913	Indian "	1	20.25	15.19	64.13	— .43
1913	Jim Holley Irr.	1	15.45	15.88	72.53	+3.86
1914	" " "	1	14.78	16.53	67.82	— .87
	Average	2	15.12	16.20	70.18	+1.50
1913	Koefert D. F.	1	15.38	13.68	70.94	
1912	Little Club D. F.	1	10.00	16.00	72.00	—2.00
1913	Little Club Irr.	1	14.41	11.86	71.19	—2.54
1914	" " "	1	11.00	13.00	77.00	+1.00
	Average	2	12.70	12.43	74.10	— .77
1912	Loft House D. F.	1	8.03	22.63	64.60	—4.74
1914	Mackay D. F.	1	9.23	19.23	70.00	—1.54
1914	Mackay Irr.	1	11.94	19.42	68.64	
1914	Marquis D. F.	1	13.34	20.00	68.32	+1.66
1913	Marquis Irr.	1	12.72	13.56	81.35	+7.63
1914	" "	3	11.29	16.34	75.75	+3.38
	Average	4	11.65	15.64	77.15	+4.44
1913	Minnesota No. 163 Irr.	1	16.53	10.59	74.16	+1.28
1913	Odessa D. F.	1	14.17	17.50	68.33	
1914	Red Claff D. F.	1	15.56	14.82	64.44	—5.18
1913	Sonora D. F.	2	14.96	20.30	62.82	—1.92
1914	" "	3	14.50	20.91	63.55	—1.04
	Average	5	14.68	20.67	63.26	—1.39
1914	Sonora Irr.	1	14.17	19.17	65.00	—1.66
1913	Tause D. F.	1	14.53	15.38	65.39	—4.70
1913	Three I D. F.	1	12.40	15.90	71.70	
1914	" " "	1	10.66	19.68	72.94	+3.28
	Average	2	11.53	17.79	72.32	+1.64

Table No. I—(Continued)—Mill Products

Year	Variety and How Grown	No. of Samples	Bran Percent.	Shorts Percent.	Flour Percent.	Gain or Loss in Milling Percent.
1912	Turkey Red D. F.	4	11.00	18.73	70.66	+ .39
1913	" " "	11	11.72	17.51	73.50	+2.73
1914	" " "	13	12.08	18.32	74.01	+4.41
	Average	28	11.78	18.06	73.33	+3.17
1912	Turkey Red Irr.	5	9.36	20.21	74.04	+3.61
1913	" " "	3	10.57	16.98	77.21	+4.76
1914	" " "	3	11.43	21.15	70.95	+3.51
	Average	11	10.26	19.58	74.06	+3.90
1912	Winter Fife D. F.	1	7.41	19.26	74.07	+ .74
1914	" " "	1	11.66	15.00	73.34	
	Average	2	9.53	17.13	73.71	+ .37
	Average all D. F.	79	12.62	17.93	70.62	+1.17
	Average all Irr.	60	12.94	17.04	71.24	+1.12

If in the preceding table, one's attention is directed to Bluestem and Turkey Red, the two varieties which seem to be most commonly grown on both dry and irrigated farms, two things are noticeable. They are (1) the lower yield of flour from the soft wheat and (2) the absence of any decided difference between dry-farmed and irrigated Bluestem and between dry-farmed and irrigated Turkey Red in the percentage of flour obtained. No decided differences in yield of mill products appear when all (79) dry-farmed samples are averaged and compared with the average for all (60) irrigated samples. Whether similar results are obtained in commercial milling, only the commercial miller can say. We suspect that they are.

The grinding is but one of the several operations considered necessary in securing substantial data upon which to base decisions with reference to comparative values for milling purposes. Samples of the cleaned wheat and of the straight flour ground from each lot were retained for analytical work and baking tests.

Flours are rated in quality in accordance with their ability to produce in the hands of the commercial baker and housewife shapely, well risen loaves with a smooth, velvety texture desirable in taste and pleasing in color of crust and crumb. Whatever may be said of other factors that affect quality, the shapely and well risen loaf depends primarily upon a reasonable percentage of elastic, spongy gluten, for it is the expansive force of gas enclosed by particles of gluten that causes dough to rise in the process preliminary to baking. Gluten results from the union of two nitrogen compounds (gliadin and glutenin) when flour is mixed with water as in the doughing process. The percentage of gluten

depends upon the percentage of protein in the flour and that in turn, as shown in bulletin No. 72, depends upon the percentage of protein in the wheat from which the flour was ground. One can, therefore, with considerable assurance forecast the percentage of gluten a flour will contain from the percentage of protein in the wheat from which it is to be ground. High protein wheats produce high protein flours—hence the importance of knowing and of being able to control the soil or other factors which tend to raise or lower the protein content of the matured wheat kernel. Lightness and shapeliness of loaf, however, are not always secured by what would generally pass as an adequate percentage of gluten. If that constituent of the flour is weak, that is, if it breaks or pulls apart readily upon stretching or pulling, another flour containing a smaller percentage of gluten but one that is tenacious in character or one that possesses that quality called sponginess or resiliency might easily give much better results in the hands of the average baker. Moreover, lightness and shapeliness of loaf, however important in themselves, are only two of the characteristics a desirable loaf should possess. It is not at all strange, therefore, that flours are frequently not arranged in the estimation of the housewife strictly in the order of their gluten content. The maintenance in flour of both quantity and quality of gluten is an exceedingly important consideration but one with which we are not primarily concerned in this immediate connection.

In addition to the determinations already mentioned, weights per bushel and per 1000 kernels were determined on all wheat samples. Moisture, ash (mineral matter), and ether extract (oil) determinations were made on both wheat and flour samples. The significance of each of these determinations is fully discussed in our former bulletin and, therefore, need not be gone into here. In Table No. 2 all analytical data on the samples of wheat secured and the flours produced from them have been compiled. As in preceding work, only the "straight" grade of flour was used.

Table No. II.—Composition of Wheat and Flour

Year	Variety, How Grown and Number of Samples.	WHEAT						FLOUR.						
		Weight		Moisture Percent.	Ash Percent.	Ether Extract Percent.	Crude Protein N x 6¼ Percent.	Moisture Percent	Ash Percent.	Ether Extract Percent	Crude Protein N x 5.7 Percent.	Gluten		Gliadin Percent
		Per Bu. Lbs.	Per 1000 Kernels gms.									Wet Percent.	Dry Percent.	
1912	Bluestem D. F. 3.....	56.7	35.44	10.46	1.83	2.04	12.49	13.34	.48	1.04	9.73	38.97	13.31	5.83
1913	" " 4.....	59.8	39.25	10.07	1.75	2.13	11.60	13.50	.44	1.25	8.82	28.57	9.67	5.42
1914	" " 5.....	58.8	37.76	9.94	1.84	2.03	11.42	11.98	.49	1.05	9.07	26.85	9.41	3.77
	Average 12	58.6	37.65	10.12	1.81	2.06	11.75	12.83	.47	1.11	9.15	30.45	10.47	4.83
1912	Bluestem Irr. 2.....	59.0	42.66	10.81	1.70	1.77	11.05	14.75	.48	1.03	8.48	33.00	10.90	5.10
1913	" " 2.....	58.7	41.52	10.07	1.72	2.14	10.41	13.84	.45	1.28	7.75	23.94	7.58	4.34
1914	" " 4.....	59.0	35.29	10.03	1.89	2.12	11.39	12.35	.52	1.18	9.43	27.74	9.58	3.99
	Average 8	58.9	38.69	10.23	1.80	2.04	11.06	13.32	.49	1.17	8.77	28.10	9.41	4.35
1912	Bluestem Haynes Irr. 1..	55.0	28.36	10.21	1.90	2.31	11.23	13.82	.59	1.31	9.36	30.11	10.65	5.24
1913	" " " 1..	59.0	33.76	10.75	1.72	2.77	12.22	13.77	.56	1.17	9.70	28.58	9.54	5.93
	Average 2	57.0	31.06	10.48	1.81	2.54	11.73	12.80	.58	1.24	9.53	29.34	10.09	5.59
1912	California Club Irr. 1....	57.0	37.34	12.71	1.48	2.20	9.56	13.60	.46	1.08	8.08	29.97	10.11	4.60
1913	Canadian Hybrid D. F. 1.	60.0	33.36	9.58	1.70	1.96	11.39	13.35	.50	1.56	9.08	27.58	8.59	4.79
1914	" " " 1.	55.0	26.30	10.91	1.89	2.11	11.17	11.80	.51	1.03	8.96	26.10	9.07	4.22
	Average 2	57.5	29.83	10.25	1.79	2.03	11.28	12.58	.50	1.29	9.02	26.84	8.83	4.51
1914	College Hybrid * Irr. 1...	55.5	23.78	9.61	2.00	2.68	11.12	12.20	.44	1.01	9.18	26.50	9.33	5.70
1913	Colorado No. 50 D. F. 1..	61.0	39.85	10.67	1.81	2.07	13.53	13.87	.47	1.30	10.30	36.13	10.88	6.16
	" " " 1..	58.5	28.78	11.92	1.85	2.22	11.10	12.64	.49	1.18	8.82	24.60	9.30	2.96
	Average 2	59.8	34.32	11.29	1.83	2.15	12.31	13.26	.48	1.24	9.56	30.36	10.09	4.51
1913	Dago Irr. 1	60.5	38.90	10.60	1.46	2.08	11.56	13.70	.49	1.48	8.58	28.02	8.50	5.25
1912	Defiance Irr. 3.....	58.0	38.15	11.83	1.63	1.93	12.57	14.97	.50	1.18	9.49	35.07	11.17	5.69
1913	" " 4.....	59.8	36.51	11.26	1.78	2.08	12.09	14.18	.52	1.28	9.37	30.76	9.87	5.59
1914	" " 3.....	60.0	34.15	9.46	1.79	2.28	10.59	12.19	.57	1.19	8.80	26.07	8.92	4.67
	Average 10	59.3	36.30	10.79	1.73	2.10	11.79	13.82	.53	1.23	9.24	30.65	9.97	5.35
1912	Dicklow Irr. 4.....	58.6	37.67	10.64	1.59	2.18	10.42	14.61	.43	1.08	7.84	28.89	9.50	4.60
1913	" " 4.....	58.6	37.67	10.64	1.59	2.18	10.42	13.70	.47	1.32	7.92	24.33	8.31	5.36
1914	" " 5.....	57.2	33.35	10.63	1.81	2.32	9.76	12.55	.53	1.14	7.88	22.62	7.84	3.58
	Average 13	57.9	35.46	10.50	1.70	2.21	10.26	13.54	.48	1.18	7.88	24.85	8.50	4.44

* No. 143

Table No. II.—(Continued)—Composition of Wheat and Flour.

Year	Variety, How Grown and Number of Samples.	WHEAT						FLOUR.						
		Weight		Moisture Percent.	Ash Percent.	Ether Extract Percent.	Crude Protein N x 6¼ Percent.	Moisture Percent	Ash Percent.	Ether Extract Percent.	Crude Protein N x 5.7 Percent	Gluten		Gliadin Percent.
		Per Bu Lbs.	Per 1000 Kernels gms.									Wet Percent	Dry Percent.	
1913	Fife D. F. 1	60.0	35.72	10.87	1.68	2.18	11.43	14.18	.40	1.28	8.92	27.88	10.03	5.93
1914	" " 1	61.5	33.07	10.19	1.87	2.30	10.81	11.95	.47	1.12	8.65	24.65	8.39	2.28
	Average 2	60.8	34.40	10.53	1.78	2.24	11.12	13.07	.43	1.20	8.78	26.27	9.21	4.10
1913	Forty Fold D. F. 1	55.5	41.16	11.16	1.76	1.75	11.60	14.59	.44	1.14	8.44	25.32	8.51	5.93
1914	" " " 1	58.0	36.36	8.97	1.75	2.42	13.90	11.67	.50	1.10	11.20	34.75	11.30	4.10
	Average 2	56.8	38.76	10.07	1.76	2.09	12.75	13.13	.47	1.12	9.82	30.04	9.90	5.02
1914	Fultz D. F. 1	56.0	32.88	11.15	1.73	2.18	13.42	13.18	.46	1.06	11.34	35.50	12.49	4.90
1912	Gold Coin D. F. 2	60.0	38.62	10.63	1.47	1.96	12.59	14.12	.42	1.32	9.84	39.89	13.56	5.10
1913	" " " 3	59.7	42.47	11.44	1.67	1.98	12.73	14.47	.41	1.07	9.95	33.78	10.52	6.39
1914	" " " 8	58.5	35.61	10.74	1.76	2.05	12.47	12.55	.48	1.04	9.62	29.92	10.15	4.82
	Average 13	59.0	37.66	10.89	1.70	2.02	12.54	13.24	.47	1.09	9.73	32.35	10.76	5.23
1913	Galgalos Irr. 1	61.0	43.58	10.69	1.76	1.86	11.34	13.94	.49	1.34	8.65	25.17	8.07	5.70
1913	Indian Irr. 1	60.5	33.66	10.02	1.81	2.32	10.16	13.31	.44	1.31	7.66	25.39	8.22	4.33
1913	Jim Holley Irr. 1	57.5	37.86	10.41	1.74	2.23	9.04	14.55	.43	1.19	6.55	17.18	6.01	3.88
1914	" " " 1	57.0	31.92	9.06	1.86	2.39	9.26	12.83	.46	1.21	7.19	21.15	7.71	3.76
	Average 2	57.3	34.89	9.74	1.80	2.31	9.15	13.69	.44	1.20	6.87	19.17	6.86	3.82
1913	Koefert D. F. 1	60.0	46.50	10.63	1.78	2.09	12.41	13.79	.41	1.06	9.62	31.87	11.11	4.79
1912	Little Club D. F. 1	59.5	33.70	10.47	1.83	2.14	10.79	12.63	.50	1.20	8.56	31.96	10.78	4.91
1913	Little Club Irr. 1	60.0	29.80	11.12	1.69	2.23	10.75	14.01	.47	1.13	8.51	26.73	8.51	5.70
1914	" " " 1	59.5	30.72	9.49	1.95	2.22	10.90	11.51	.49	1.22	9.18	26.30	9.25	3.53
	Average 2	59.8	30.26	20.31	1.82	2.22	10.83	12.76	.48	1.18	8.85	26.51	8.88	4.61
1912	Lofthouse D. F. 1	59.0	51.30	9.63	1.89	1.82	11.05	13.61	.42	1.08	8.06	32.13	10.75	4.58
1914	Mackay D. F. 1	59.0	32.46	9.37	1.85	2.04	14.38	11.80	.59	1.07	11.42	37.70	12.11	4.56
1914	Mackay Irr. 1	60.0	32.20	8.98	2.09	1.95	13.95	11.86	.51	.94	10.82	32.95	11.26	4.56
1914	Marquis D. F. 1	57.0	26.62	11.76	1.85	2.52	14.78	13.45	.58	1.34	11.94	35.80	12.95	5.70
1913	Marquis Irr. 1	62.0	33.84	10.78	1.71	2.45	11.25	13.93	.56	1.08	9.50	32.78	10.64	5.70
1914	" " 3	60.3	34.20	10.00	1.76	2.38	12.47	12.18	.61	1.21	10.31	31.25	11.03	4.68
	Average 4	60.8	34.11	10.19	1.75	2.40	12.17	12.62	.60	1.18	10.11	31.63	10.93	4.93

Table No. II.—(Continued)—Composition of Wheat and Flour.

Year	Variety, How Grown and Number of Samples.	WHEAT						FLOUR.						
		Weight		Moisture Percent.	Ash Percent.	Ether Extract Percent.	Crude Protein N x 6¼ Percent	Moisture Percent.	Ash Percent.	Ether Extract Percent.	Crude Protein N x 5.7 Percent.	Gluten		Gliadin Percent.
		Per Bu. Lbs.	Per 1000 Kernels gms.									Wet Percent.	Dry Percent.	
1913	Minnesota No. 163 Irr. 1..	59.0	35.30	11.17	1.84	2.57	12.41	14.37	.48	1.14	9.38	29.53	10.07	5.48
1913	Odessa D. F.	59.5	33.84	9.75	1.72	2.29	11.60	14.07	.39	1.03	9.28	28.03	10.62	5.70
1914	Red Chaff D. F. 1.....	58.5	24.58	9.37	1.96	2.19	14.03	11.92	.53	.99	11.06	33.15	11.57	5.24
1913	Sonora D. F. 2.....	63.3	35.43	11.20	1.72	2.04	11.21	13.82	.46	1.33	8.88	27.04	9.73	5.93
1914	" " 3.....	62.8	29.81	10.32	1.72	2.10	11.98	12.07	.54	1.23	9.73	30.28	10.42	4.33
	Average 5	63.0	32.06	10.67	1.72	2.08	11.67	12.77	.51	1.37	9.39	28.99	10.14	4.97
1914	Sonora Irr. 1.....	61.0	25.56	9.81	1.79	2.20	11.56	11.68	.53	1.37	9.34	28.65	10.17	4.16
1913	Tause D. F. 1	52.0	35.66	10.30	1.76	2.08	9.65	13.49	.45	1.22	7.48	24.62	7.47	5.93
1913	Three I D. F. 1.....	58.5	34.66	9.95	1.58	2.40	10.64	12.87	.44	1.19	7.70	23.66	7.46	5.02
1914	" " 1.....	55.0	25.82	9.00	1.81	2.40	10.64	11.32	.50	1.11	9.10	27.15	9.73	4.56
	Average 2	56.8	30.24	9.48	1.69	2.30	10.27	12.09	.47	1.15	8.40	25.40	8.59	4.79
1912	Turkey Red D. F. 4.....	60.3	32.41	10.74	1.62	1.96	12.19	14.08	.44	1.10	9.54	34.32	11.51	5.39
1913	" " " 11...	59.7	32.58	10.26	1.66	1.98	14.56	13.66	.47	1.20	11.60	40.77	12.02	7.14
1914	" " " 13....	60.5	31.39	10.17	1.69	1.98	14.97	12.30	.52	1.08	12.43	42.12	13.52	6.02
	Average 28	60.1	32.00	10.29	1.67	1.97	14.41	13.09	.49	1.13	11.69	40.48	12.69	6.37
1912	Turkey Red Irr. 5.....	60.1	39.36	10.28	1.72	1.87	10.44	13.88	a .52	1.07	8.24	30.67	10.67	4.48
1913	" " " 3.....	61.3	39.82	9.99	1.88	1.74	11.46	13.48	.54	1.13	9.42	31.38	9.73	5.40
1914	" " " 3.....	59.8	37.22	10.51	1.76	1.93	11.59	12.31	.52	1.04	9.49	32.92	10.79	4.90
	Average 11	60.4	38.90	10.26	1.77	1.85	11.04	13.34	b .55	1.08	8.90	31.48	10.45	4.85
1912	Winter Fife D. F. 1.....	61.0	34.06	10.76	1.56	2.18	11.14	14.03	.40	1.06	9.04	36.20	12.28	5.72
1914	" " " 1.....	60.0	33.56	9.19	1.66	1.99	11.69	12.47	.44	.95	8.94	30.85	10.29	4.33
	Average 2	60.5	33.81	9.98	1.61	2.08	11.42	13.25	.42	1.00	8.99	33.53	11.28	5.03
Average all D. F. 79		59.5	34.40	10.38	1.72	2.05	12.87	13.03	.48	1.13	10.23	31.25	11.21	5.46
Average all Irr. 60		59.1	36.01	10.43	1.76	2.13	11.07	13.39	c .51	1.17	8.76	28.39	9.53	4.78
Average of all varieties except Turkey Red														
	Dry-Farmed 51	59.01	35.72	10.43	1.76	2.09	12.01	12.99	.47	1.14	9.43	26.18	10.43	4.96
	Irrigated 49	58.82	35.36	10.46	1.76	2.19	11.08	13.40	.50	1.19	8.73	27.70	9.32	4.77

(a) average of 4. (b) average of 10. (c) average of 59.

If again one's attention is directed to the Bluestem and Turkey Red samples, several facts are outstanding. There is not a decided difference between the average dry-farmed and the average irrigated sample in weight per bushel but the irrigated is slightly heavier. In weight per 1000 kernels the difference is more pronounced—decidedly so in the case of Turkey Red. In moisture, ash, and ether extract, both wheat and flour show no differences that would serve to identify them with the system of farming under which they were produced. The remarkable fact is the comparatively slight difference between dry-farmed and irrigated Bluestem in protein and the decided difference between dry-farmed and irrigated Turkey Red in that constituent. Between the flours from dry-farmed and irrigated Bluestem a difference of only .38 per cent in protein is to be noted and only 2.35 per cent and 1.06 per cent respectively in wet and dry gluten. Between the flours from the average dry-farmed and irrigated Turkey Red the difference for protein is 2.79 per cent and for wet and dry gluten 9 per cent and 2.24 per cent respectively. The ratio of wet to dry gluten in both dry-farmed and irrigated Bluestem is 2.9; that ratio for dry-farmed Turkey Red is 3.2; for irrigated Turkey Red it is 3. Relative strength of flours to a certain extent is believed to be indicated by the relative amounts of water their glutens absorb. Flour from dry-farmed Turkey Red by this test would seem to be slightly superior to that ground from the irrigated.

The smaller number of samples representative of other varieties grown under both dry-farmed and irrigated conditions deter one from attempting to go so far in the interpretation of the analytical data but the comparatively small differences in protein on wheat and flour between dry-farmed and irrigated Little Club, Sonora, and Mackay is noticeable. With Marquis the difference is more pronounced. Differences in ratio for wet and dry gluten are insignificant. Dry-farmed Little Club and Sonora have the greater weight per 1000 kernels and dry-farmed Sonora is decidedly heavier in weight per bushel. The greater differences in Marquis suggests as it did with Turkey Red that possibly some varieties are more susceptible than others to the "deteriorating" influences of unduly large amounts of irrigation water.

If now, irrespective of varieties, the average of the 79 dry-farmed samples is compared with the average of the 60 irrigated samples, it will be again noted that in weight per bushel the difference is slight. In weight per 1000 kernels it is more decided. In protein the average dry-farmed wheat shows only 1.80 per cent and its flour only 1.47 per cent higher than the irrigated. The differences in wet and dry gluten are 2.86 per cent and 1.68 per cent respectively. The ratio of wet to dry gluten is practically the same, 2.8 and 2.9.

The pronounced differences between dry-farmed and irrigated Turkey Red suggested the advisability of a summation of analytical data in which that variety would not be represented. In the last two lines of Table No. 2 a summation on that basis is shown. Again there appear no significant differences in weight per bushel, in weight per 1000 ker-

nels or in percentages of moisture, ash and ether extract. The protein of the average dry-farmed sample is almost one per cent greater. The protein of its flour is seven-tenths percent greater—differences too small to be reflected strongly in the gluten percentage either wet or dry.

The baking tests were conducted by extension workers in the Department of Home Economics who saw in the large number of flour samples an unusual opportunity to acquaint themselves with the characteristic behavior of flours about which they are frequently asked. Altho the tests were conducted in the laboratory, home conditions were approached as closely as possible. The results secured in many ways do not support the commonly held views regarding the relative values for bread making purposes of dry-farmed and irrigated wheats. In some ways they emphasize the complexity of the several factors concerned in determining what is and what is not good flour. The procedure adopted for the tests and results secured are presented and discussed in Part 2.

BAKING TESTS.

By AMY KELLY and ELIZABETH HAYS

The relative merits of flours made from dry-farmed and irrigated wheats is a much debated question in some sections of this state. The consensus of opinion seems to be that the dry-farmed product in some ways at least is superior for bread-making purposes. The large number of flour samples obtained by the department of Agricultural Chemistry in its work with the dry-farmed and irrigated wheats presented a splendid opportunity to extension workers in Home Economics to secure thru practical baking tests first hand information on this question. In improving that opportunity a great deal of valuable information was also secured on the peculiarities of flours made from different varieties of wheat. Suggestions given in answer to frequent inquiries as to what constitutes the proper manipulation of flour and dough in the bread-making processes are now based upon first hand acquaintance with all kinds of Idaho flour. This report, however, is intended primarily to present only the results secured in the baking tests on flours made from dry-farmed and irrigated wheats.

Twenty-nine varieties of wheat are represented by the baking tests. As indicated in Table III, thirteen varieties were grown on dry-farms only, ten on irrigated farms only, and six under both dry-farmed and irrigated conditions.

Laboratory results in bread-baking are sometimes not as strictly comparable to those secured under average home conditions as one might wish. In this work, however, the standard of the housewife was made the standard of the laboratory. In scoring the loaves, grain and texture, flavor and general appearance were judged most critically. The following short process recipe was used thruout:

Flour	340 grams	Sugar	1 teaspoonful
Water	170—220 c. c.	Salt	¾ teaspoonful
Yeast	1 cake (Fleischmann's compressed)	Fat	1 teaspoonful (more or less)

The weight of flour and the measured portion of yeast, sugar, and salt were constant. The amount of water employed varied wth the kind of flour as did also the measure of fat.*

The yeast was dissolved in 20 c. c. of lukewarm water. To this solution were then added the salt, sugar, fat, and most of the water thought necessary to make a loaf of the right consistency with the 340 grams of flour. A thoro mixture of flour and other ingredients was secured by beating while the flour was being added. When a stiff dough had been obtained, it was kneaded well, placed in a jar, covered and allowed to stand in the proving oven at 32 degrees Centigrade (90 degrees Fahrenheit) until it had doubled its bulk. The dough was then again thoroly kneaded, shaped into a loaf, placed in a greased pan and allowed to rise at a temperature of 32 degrees Centigrade. When the loaf had doubled its bulk it was weighed and placed in an oven heated to 175 degrees Centigrade (347 degrees Fahrenheit). The temperature was allowed to rise to 200 degrees Centigrade (392 degrees Fahrenheit), remain there for 45 minutes, and then to slowly fall. The total time for baking was 60 minutes. Shortly after removal from the oven, the loaf was weighed. It was then placed in a cool, dry place where it was allowed to stand for twenty-four hours before being scored. Two separate bakings of two loaves each were made from each flour. In cases of very low scoring the baking was repeated but a sponge was used instead of the recipe mentioned above. As a rule this procedure made very little difference in the results. Crisco was the fat used.

In scoring the loaves, the following score card was used:

Flavor	35 points	Crumb	
Lightness	15 points	Color	
Grain and texture	30 points	Doughiness	5 points
Crust		Loaf	
Color		Shape	
Depth		Size	5 points
Texture	5 points	Moisture	5 points

The perfect loaf has a "nutty" flavor said to be characteristic of bread made from hard spring wheats; it is well risen; its grain is soft and velvety and its pores are evenly distributed; the crust is golden brown, the crumb creamy white; it is symmetrical in shape, of medium size and its moisture content is such that the crumb will fall apart when rubbed between the thumb and fingers. Average results only have been entered in the table.

*In this procedure the custom of the housewife was reversed. She employs a definite amount of liquid and then adds flour sufficient to make dough of the right consistency.

Table No. III—Summarized Results of Baking Tests.

Year	Kind of Wheat Flour Was Ground From.	How Wheat Was Grown	Number of Samples, Averaged	Water Absorbed per 340 Grams c c	Weight of Baked Loaf. Grams	Volume of Loaf c c	SCORE. Flavor Points	Lightness Points	Grain and Texture Points	Crust Points	Crumb Points	Shape of Loaf Points	Moisture Points	Total Points
1912	Bluestem	D. F.	3	214	480.3	1489	31.1	13.5	23.8	3.6	3.8	4.3	4.8	84.9
1913	"	"	4	187		1430	31.2	13.7	24.8	3.5	3.3	3.5	3.5	83.5
1914	"	"	5	175	452.0	1292	29.7	12.1	22.1	3.4	3.6	3.6	3.5	78.0
	Average		12	189	a 462.6	1387	30.5	12.9	23.4	3.5	3.6	3.7	3.8	81.4
1912	Bluestem	Irr.	2	218	482.0	1426	29.1	13.6	20.0	4.3	3.8	4.1	4.8	79.7
1913	"	"	2	188		1454	31.7	14.2	23.7	3.5	4.0	3.5	4.2	84.8
1914	"	"	3	177	467.0	1234	28.3	12.1	22.3	3.3	3.5	3.3	3.3	76.1
	Average		7	192	b 473.1	1351	29.5	13.1	22.0	3.6	3.7	3.6	4.0	79.5
1912	Bluestem Haynes	Irr.	1	220	479.8	1412	31.0	12.8	24.6	3.6	4.4	3.6	4.6	84.6
1913	" "	"	1	190		1397	33.0	14.0	27.0	4.0	3.5	4.0	3.5	89.0
	Average		2	205	479.8	1404	32.0	13.4	25.8	3.8	3.8	3.9	4.1	86.8
1912	California Club	Irr.	1	217	474.8	1422	31.2	12.5	21.2	4.2	4.0	4.5	3.2	80.8
1913	Canadian Hybrid	D. F.	1	185		1393	32.5	14.5	27.5	4.5	4.0	4.0	4.0	91.0
1914	" "	"	1	185	454.1	1366	29.0	12.0	23.5	3.5	3.0	3.0	3.5	77.5
	Average		2	185	454.1	1379	30.8	13.2	25.5	4.0	3.5	3.5	3.7	84.2
1914	College Hybrid No. 143	Irr.	1	180	563.0	1470	25.5	12.5	17.0	2.5	2.0	3.5	2.5	65.5
1913	Colorado No. 50	D. F.	1	180	447.2	1473	30.0	13.5	26.5	4.5	4.0	4.0	4.0	86.5
1914	" "	"	1	180	438.8	1318	33.5	14.0	28.5	4.5	4.5	4.5	5.0	94.5
	Average		2	180	443.0	1396	31.8	13.7	27.5	4.5	4.2	4.3	4.5	90.5
1912	Dago	Irr.	1	190		1481	30.5	14.5	26.0	3.5	4.5	3.5	4.5	87.0
1912	Defiance	Irr.	3	218	491.7	1356	30.6	12.3	18.7	3.9	4.1	4.7	4.3	78.6
1913	"	"	4	186	447.0	1315	28.0	14.5	21.3	3.8	3.0	3.8	3.0	77.4
1914	"	"	3	182	461.6	1310	31.3	12.8	25.8	3.8	3.6	3.6	3.6	84.5
	Average		10	194	474.5	1325	29.8	13.3	21.9	3.8	3.5	4.0	3.6	79.9
1912	Dicklow	Irr.	4	217	477.5	1393	28.3	11.7	21.0	4.2	4.0	4.4	4.5	78.1
1913	"	"	4	187		1427	31.0	14.0	22.1	3.7	3.8	3.2	3.8	81.6
1914	"	"	4	170	452.9	1313	28.5	12.0	21.0	3.3	3.3	3.6	3.4	75.1
	Average		12	191.7	c 463.8	1378	29.2	12.5	21.4	3.7	3.7	3.7	3.9	78.1

a average of 8. b average of 5. c average of 8.

Table No. III.—(Continued)—Summarized Results of Baking Tests.

Year	Kind of Wheat Flour Was Ground From.	How Wheat Was Grown	Number of Samples, Averaged	Water Absorbed per 340 Grams c c	Weight of Baked Loaf. Grams	Volume of Loaf c c	SCORE. Flavor Points	Lightness Points	Grain and Texture Points	Crust Points	Crumb Points	Shape of Loaf Points	Moisture Points	Total Points
1913	Fife	D. F.	1	180	432.5	1441	27.0	13.0	19.0	3.0	2.0	3.0	2.5	69.5
1914	"	"	1	172	448.1	1334	28.2	12.2	17.5	3.7	3.2	3.0	3.2	71.0
	Average		2	176	440.3	1387	27.6	12.6	18.2	3.4	2.6	3.0	2.8	70.2
1913	Forty Fold	D. F.	1	185		1481	30.0	14.0	21.0	3.0	3.0	3.5	3.0	77.5
1914	" "	"	1	170	453.5	1277	27.5	12.0	19.2	4.0	4.0	4.0	3.2	73.9
	Average		2	177	453.5	1379	28.7	13.0	20.1	3.5	3.5	3.8	3.1	75.7
1914	Fultz	D. F.	1	186	441.7	1270	28.0	12.5	21.0	4.0	3.5	4.0	4.0	77.0
1912	Gold Coin	D. F.	2	223	481.3	1516	27.5	10.4	18.3	3.4	4.0	4.5	5.0	73.1
1913	" "	"	3	185	475.5	1419	26.0	12.8	20.0	3.6	2.6	3.3	2.6	70.9
1914	" "	"	7	175	456.2	1302	28.8	12.4	22.0	3.4	3.1	3.4	3.4	76.5
	Average		12	186	a 463.2	1367	27.9	12.2	20.9	3.5	3.1	3.5	3.5	74.6
1913	Galgalos	Irr.	1	190		1433	28.5	14.5	18.5	3.5	4.0	3.5	4.0	76.5
1913	Indian	Irr.	1	190		1437	27.0	13.5	22.5	3.0	4.0	3.0	4.0	77.0
1913	Jim Holley	Irr.	1	190		1576	32.5	14.0	25.0	4.0	4.0	3.0	4.0	86.5
1914	" "	"	1	180	466.2	1294	28.5	13.0	22.5	3.5	3.0	3.0	3.0	76.5
	Average		2	185	466.2	1435	30.5	13.5	23.8	3.7	3.5	3.0	3.5	81.5
1913	Koefert	D. F.	1	192		1542	22.5	12.5	15.0	2.5	3.0	3.0	3.0	61.5
1912	Little Club	D. F.	1	228	496.2	1399	28.3	10.3	25.0	3.6	3.3	4.6	4.3	79.4
1913	Little Club	Irr.	1	185		1446	27.5	13.5	21.0	3.0	3.5	3.5	3.5	75.5
1914	" "	"	1	182	452.7	1330	30.0	12.0	24.2	3.2	3.2	3.0	3.5	79.1
	Average		2	183	452.7	1388	28.8	12.7	22.6	3.1	3.4	3.2	3.5	77.3
1912	Loft House	D. F.	1	216	476.3	1572	21.6	15.0	25.0	3.0	2.5	3.0	4.5	74.6
1914	Mackay	D. F.	1	182	458.2	1447	21.0	13.5	19.5	3.5	2.5	3.5	2.5	66.0
1914	Mackay	Irr.	1	170	458.9	1368	24.7	12.0	20.0	3.0	2.7	3.0	3.2	68.6
1914	Marquis	D. F	1	174	457.4	1441	29.5	12.7	23.2	4.2	4.2	4.2	4.2	82.2
1913	Marquis	Irr.	1	190		1366	32.5	13.5	26.5	4.0	3.5	3.5	4.0	87.5
1914	"	"	2	183	459.2	1299	32.5	13.7	27.5	4.0	3.7	3.7	4.0	89.1
	Average		3	185	459.2	1321	32.5	13.6	27.2	4.0	3.6	3.6	4.0	88.5

a average of 10.

Table No. III.—(Continued)—Summarized Results of Baking Tests.

Year	Kind of Wheat Flour Was Ground From.	How Wheat Was Grown	Number of Samples, Averaged	Water Absorbed per 340 Grams c c	Weight of Baked Loaf, Grams	Volume of Loaf c c	SCORE. Flavor Points	Lightness Points	Grain and Texture Points	Crust Points	Crumb Points	Shape of Loaf Points	Moisture Points	Total Points
1913	Minnesota No. 163	Irr.	1	180	456.0	1711	30.0	15.0	25.0	4.0	4.0	4.0	5.0	87.0
1913	Odessa	D. F.	1	190		1499	32.5	14.0	27.0	3.5	4.0	3.0	4.0	88.0
1914	Red Chaff	D. F.	1	172	481.0	1344	31.0	14.0	27.5	4.0	3.5	4.5	3.5	88.0
1913	Sonora	D. F.	2	190		1520	30.7	14.0	25.0	4.0	3.2	4.0	3.2	84.1
1914	"	"	3	176	488.1	1339	28.6	13.0	23.6	3.8	3.3	3.9	3.2	79.4
	Average		5	182	a 488.1	1412	29.5	13.4	24.2	3.9	3.3	3.9	3.2	81.4
1914	Sonora	Irr.	1	170	467.6	1353	33.0	13.0	28.0	5.0	4.0	4.0	5.0	92.0
1913	Tause	D. F.	1	187		1505	28.0	13.5	17.5	3.5	4.0	3.0	4.0	73.5
1913	Three I	D. F.	1	185		1335	26.0	14.0	25.0	3.5	3.5	3.5	3.5	79.0
1914	"	"	1	171	451.8	1267	23.7	10.2	16.7	3.0	2.2	3.2	2.2	61.2
	Average		2	178	451.8	1301	24.9	12.1	20.8	3.2	2.9	3.3	2.9	70.1
1912	Turkey Red	D. F.	4	221	486.2	1442	31.1	14.4	24.0	4.1	4.2	4.6	4.9	87.3
1913	" "	"	8	189	459.5	1475	30.7	14.1	23.6	4.1	3.5	3.6	3.6	83.2
1914	" "	"	9	185	456.7	1296	30.1	13.1	25.9	4.2	3.8	3.9	3.9	84.9
	Average		21	193	465.4	1330	30.5	13.7	24.7	4.2	3.7	3.9	4.0	84.7
1912	Turkey Red	Irr.	5	219	491.3	1362	29.8	12.9	25.4	4.3	4.3	4.6	4.6	85.9
1912	Winter Fife	D. F.	1	217	490.0	1308	31.2	13.7	24.5	4.0	3.7	4.5	4.5	86.1
1914	" "	"	1	170	453.0	1163	23.0	11.0	12.5	3.0	2.2	3.0	2.5	57.2
	Average		2	243	471.0	1235	27.1	12.3	18.5	3.5	3.0	3.7	3.5	71.6
Av. of those grown with Irr. only			32	187	474.0	1388	29.6	13.1	22.0	3.7	3.7	3.8	3.8	79.7
Av. of those grown on D. F. only			30	189	459.0	1376	28.3	12.7	21.5	3.6	3.2	3.5	3.5	76.3
Average all		D. F.	71	188	b 463.8	1369	29.2	13.1	23.0	3.7	3.5	3.7	3.7	79.9
Average all		Irr.	51	193	c 474.0	1375	29.7	13.1	22.7	3.7	3.7	3.8	3.9	80.6

a average of 3. b average of 50. c average of 35.

In the above table one ought to consider first of all results secured from flours ground from varieties that were grown under both dry-farmed and irrigated conditions, six in all. In the case of Bluestem and Little Club the dry-farmed flours produced the higher scoring loaves. With all other varieties of this class, the irrigated products scored higher. Of these six varieties, Bluestem and Turkey Red are represented by the greatest number of loaves. Dry-farmed Bluestem produced higher scoring loaves than irrigated Bluestem; irrigated Turkey Red produced higher scoring loaves than did dry-farmed Turkey Red.

Comparing next results secured from those varieties that were grown under irrigation only with those secured from varieties that were grown under dry-farm practice only, the irrigated product, represented by thirty-two loaves, scored higher than the dry-farm product, represented by thirty loaves, by 3.4 points. Finally, the average scoring on loaves, seventy-one in number, representing all dry-farmed samples was lower by .7 of a point than the average score on those loaves, fifty-one in number, that represented all irrigated samples. From all of which it would seem that one is justified in concluding that in so far as home baking is concerned it matters but little whether our milling wheat is produced under dry-farmed or irrigated conditions.

It is to be admitted that the scoring was severe. It is plain, however, that certain varieties of wheat produce flour that is decidedly inferior to that of other varieties. The results of these baking tests suggest the possibility of making greater progress toward the raising of flour standards in this state by systematic insistence on the part of housewives for brands that have been ground from the better varieties than by discriminating in favor of either the dry-farmed or irrigated product.

In these results data taken with reference to weight and volume of the baked loaves have no very special significance. One would think that the greater the amount of water absorbed the greater would be the weight of the baked loaf and that in general is true. The final weight, however, depends also upon the temperature of the baking oven and the time consumed in baking—factors which might offset the first mentioned one. Unless one is baking for volume there can be no very close correlation between gluten percentages (see Table II, Part I) and volume of loaf. Moreover, since volume of loaf is only one of the factors concerned in the production of the perfect loaf, there may not be a close correlation between volume data and final score. Finally, while these results do not minimize the influence of adequate percentages of gluten, it is plain that comparatively large differences in gluten percentages are not sharply reflected in results secured from different flours under what may be called home baking conditions. This conclusion is perfectly in accord with that expressed as the result of work recorded in bulletin No. 72.

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