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Missouri Flour for Missouri Breadmaking

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THIS BULLETIN AT A GLANCE

Missouri Flour for Missouri Breadmaking

(Contribution by the Department of Home Economics)

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Abstract.—This bulletin deals with the results of an investigation of some of the problems involved in the use of Missouri soft winter wheat flour in breadmaking. There is a large quantity of Missouri soft wheat flour produced but only about fifteen per cent of all this amount is used within the State. The investigation reported proves that good bread can be made from Missouri flour. This bread is comparable in quality to that made with flour from other states. It requires from two to four hours less time to make a loaf of bread from Missouri soft flour than it does to make a loaf of bread from hard flour. A recipe, with detailed instructions for using, is given.

Bread is generally recognized as one of our most valuable foods. Ever since the earliest discovery and cultivation of wild cereals, men have known that food prepared from these cereals would support life and strength better than any other single food except milk. Today food specialists, in agreement with the recent discoveries in the science of nutrition, advocate the use of bread in combination with the great protective foods, milk, fresh fruits, and leafy vegetables.

In many countries bread is considered the "staff of life." In this country it seems less important on account of the ease with which a variety of other foods can be obtained. Nevertheless, bread has an important place in our diet. The average annual consumption of wheat in the United States from 1905 to 1914 was approximately one barrel of flour for each one of our 100,000,000 inhabitants.

IMPORTANCE OF WHEAT

Of all the grains, wheat is the most extensively used for breadmaking because it contains a large amount of gluten. Gluten is the elastic, gumlike substance obtained when flour is moistened and allowed to stand, and which gives to dough its pliable and tenacious character.

The climate and soil of the United States are very favorable to the growth of an enormous quantity of wheat and thus our country leads the world in its production. Most farmers grow some wheat because it is especially satisfactory in the system of crop rotation, and this also adds to the amount of wheat grown and to its importance.

Classes of Wheat and Their Characteristics.—Wheats are commonly divided into two main classes: soft wheats and hard wheats. The

following table gives the principal characteristics of these classes and of the flours made from them.

Soft	Hard
Soft Winter Wheat Flour	Hard Winter Wheat Flour Hard Spring Wheat Flour
1. Larger and softer grains. 2. Flour has a smooth powdery texture. 3. Small proportion of gluten (usually). 4. Will absorb a small quantity of water. 5. Known as a "soft" flour and sometimes as a "weak" flour. 6. Often called "pastry" flour.	1. Harder and smaller grains. 2. Flour has a granular texture. 3. Large proportion of gluten (usually). 4. Will absorb large quantity of water. 5. Known as a strong, hard-wheat flour. 6. Often called "bread" flour.

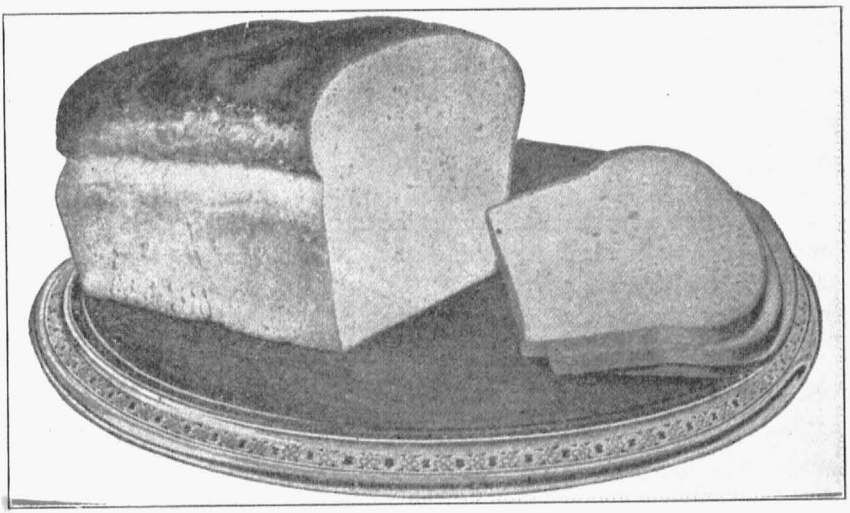


Fig. 1.—Bread made from hard wheat flour. Courtesy U. S. Department of Agriculture.

Increasing Importance of Winter Wheat and Missouri's Rank in its Production.—Since the introduction of the hardy varieties of wheat from Southeastern Europe there has been a decided northward movement of the winter wheat area until now winter wheat comprises almost two-

thirds of the total wheat acreage. This acreage is divided almost equally between the soft and hard varieties of winter wheat. Of all the states producing soft winter wheat Missouri ranks first. Ninety-four per cent of all the wheat grown in the State is soft winter wheat.

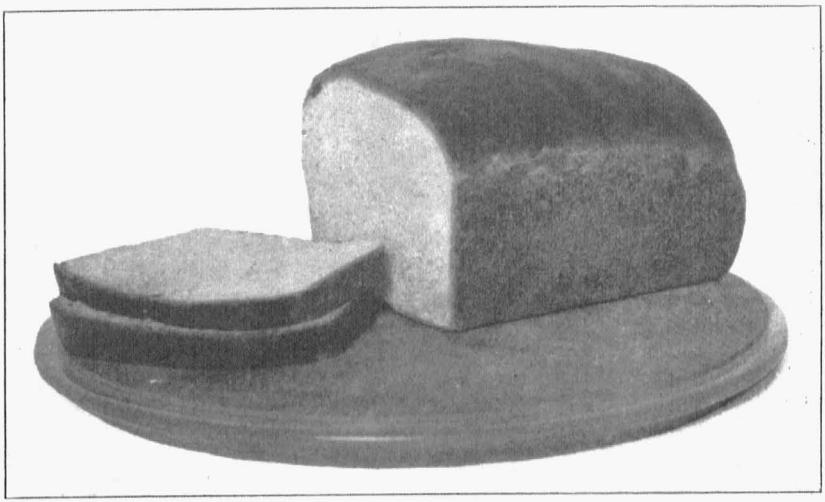


Fig. 2.—Bread made from Missouri soft winter wheat flour at the Missouri Experiment Station.

MISSOURI'S PROBLEM WITH REGARD TO THE USE OF MISSOURI FLOUR WITHIN THE STATE

The importance of using homegrown products was emphasized by the World War; but, nevertheless, the majority of the bakers of the State and many of the country people use flour from other states for breadmaking. Statistics[1] show that only 15 per cent of all the flour produced in Missouri is consumed within the State. The distribution of Missouri flour according to the same authority, is about as follows:

60 % to Southern States
10 % to Eastern States
10 % to Northern States
5 % to Western States
15 % to Missouri

Missouri people consume 3,500,000 barrels of flour annually, or 17,000,000 bushels of wheat. They produce about 30,000,000 bushels of wheat annually of which—as mentioned above—only 15% is distributed for consumption in this State.

[1]Bulletin "Missouri Soft Wheat Flour," Missouri State Board of Agriculture.

The cost of bread in Missouri is higher because of the payment of the transportation charges for shipping the wheat out of the State and for shipping other flour in. A large part of the wheat is milled out of the State with the result that the supply of mill feed available to the Missouri farmers is greatly reduced. Additional feed must be shipped in at a high price. This adds considerably to the cost of milk and meat, production. These articles of food when produced by expensively fed animals must necessarily be sold at high prices.

Bread comparable in quality to that produced from wheat grown in other states can be made from soft wheat flour. Originally Americans used nothing but soft wheat flour for breadmaking. Extensive advertising on the part of hard wheat millers, however, caused many people to turn to the use of hard wheat flour. They found it would make light bread to a slightly better advantage than soft wheat flour. Especially is this true from the commercial baker's standpoint. The baker likes a flour that will absorb a large amount of water, yield a large loaf of a desirable shape, with good color and texture. He can thus bake more loaves of bread from a given quantity of flour and make a greater profit.

Soft wheat flour takes up less water than hard wheat flour, and gives, ordinarily, a loaf of less volume. For the baker this might be a detriment; but in the home, where the housewife selects food more for its nutritive value, this fact is really a decided point in its favor.

Many foreign countries produce this soft winter type of wheat and use the flour for breadmaking. England, Sweden, and Holland are among these, while French bread made from soft wheat flour is claimed to be the very best in the world.[2]

There is a large quantity of soft winter wheat flour available in this State and the housewife can get it cheaper here. She can thus directly benefit herself and give stronger support to the agriculture of the State. Experimental work has been done with Missouri soft winter wheat flour for the purpose of showing the housewife that with slight modifications in her recipe, she can make as good bread with soft as with hard wheat flour.

OBJECTS OF BREADMAKING

Flour as it comes from the miller is not fitted for ordinary consumption. The baker's object is to make from it an article pleasing to the sight, agreeable to the taste, nutritious, easily digested and convenient for use.[3]

It is universally admitted that these ends are best accomplished by mixing the flour with liquid so as to form a dough, by charging the dough

[2]Bulletin 13, "Foods and Adulterants", Division of Chem. U. S. Dept. of Agr., Part IX, p. 1235.
[3]Bulletin 285, Ontario Department of Agriculture.

with gas and separating the particles of flour through the agency of yeast, by moulding the dough into shapes convenient to handle; and by baking it when in the raised condition so that the porous structure may be maintained. The result is a loaf with a delicate, spongy structure, which causes good bread to be one of the most readily and easily digested of all wheat foods.[3,4]

INGREDIENTS IN BREAD

As indicated in the foregoing pages, flour, liquid, and yeast are the most essential ingredients for making bread, but sugar, salt, and shortening add greatly to the quality of the final product.

An examination of many recipes for making bread from ordinary "bread" flour (hard winter or hard spring wheat flour) shows a wide variation in the proportions of ingredients used. But all authorities agree that good quality of materials is the first requisite to insure success in breadmaking.

HOW TO MAKE GOOD BREAD FROM MISSOURI FLOUR

Experiments comparing the proportion of ingredients which give the best results for the hard and soft flours have shown that, in general, the soft type of flour requires the use of more sugar, more yeast and less water, but a relatively softer dough.

No two different stocks of flour taken from the same brand will give the best results by following a fixed recipe. Every brand of flour, every lot of flour behaves differently and thus each lot must be handled differently to give the best results. Hence breadmaking is an art and a science.

As a result of experimentation the following recipe has been formulated, and found to produce satisfactory bread:

Recipe for Bread from Soft Winter Wheat Flour. (Proportions for one-pound loaf).—All measurements are level, the flour sifted once before measuring, and the measuring cup filled lightly to avoid packing.

PROPORTION OF INGREDIENTS

3½ cups flour*	4 teaspoons sugar
⅝ to ¾ cups water†	1 teaspoon lard
1 cake compressed yeast	1 teaspoon salt

*About 3 cups before sifted.
†Directions for determination of correct amount given below.

The Effect of Procedure on Quality of Bread Made from Soft Winter Wheat Flour.—The importance of mixing, kneading, fermentation and baking in regard to their influence upon the quality of the loaf of bread can scarcely be over-estimated. Breadmaking is so complex a

[4]The Technology of Breadmaking, by Wm. J. Jago.

process, includes so many factors and variables, that the strictest attention to detail is necessary if an ideal loaf of bread is to be secured.

Method of Procedure.—The successful use of Missouri soft wheat flour in breadmaking depends to a large extent upon the use of the proper amount of liquid. Follow carefully the directions given below with regard to the determination of the proper amount.

PRELIMINARY FERMENTATION TEST

(1) Measure the sugar into a bowl;

(2) Break up the yeast and add to the sugar. Yeast should have a creamy color with a grayish brown tint; should be only slightly moist breaking with a clean fracture and a faint click.[5]

(3) Add ½ cup of lukewarm water (about 90° F.) to the sugar and yeast; set in a warm place for 30 minutes. Set in pan of warm water (95°-100° F.), rather than over a radiator or too near intense heat. Keep temperature of mixture even (80°-90°F.)

After the first baking from each sack of flour, the amount of water recorded as correct from the first baking should be added all at once to the sugar and yeast.

(1) Sift flour and measure into a bowl; set in a warm place, preferably in warming oven or over hot water. Flour should be warmed only slightly (80°-90°F.), to prevent its chilling the yeast mixture and retarding fermentation. A chemical thermometer is an invaluable aid to success in making bread.

(2) When the sugar, yeast and water have been fermenting almost 30 minutes, measure the lard into the mixing bowl and place in oven until lard is melted.

(3) Measure salt and add to lard.

(4) At the end of the thirty minutes, the yeast mixture should be foamy. This preliminary fermentation tests the quality of the yeast and lessens the time required for later fementaton or rising periods. Stir the yeast mixture thoroughly and add to the salt and lard.

(5) Add enough of the warmed flour to make a thin batter; beat thoroughly for one minute.

(6) Add remainder of the flour gradually.

(7) Measure one-fourth cup of lukewarm water; add liquid slowly and carefully until a soft dough is formed; one-half to one-third of the liquid last measured will usually be sufficient. About ⅝ to ¾ cup of liquid is usually required for 3½ cups of sifted soft wheat flour. The dough should be so soft that it must be handled quickly to prevent its sticking to the fingers and to the board. It should be just stiff enough to hold its shape and spring back when touched with the finger. Soft winter wheat flour requires a soft dough for the best results.

Calculate the total amount of water required: add the ½ cup used in the Preliminary Fermentation Test (step 3) to the amount required, ⅛ to ¼ cup, at the last addition (step 7). Record this amount and

[5]Bulletin 285, Ontario Department of Agriculture.

follow this proportion for the sack of flour that is being used. After the first test baking from each sack of flour, step 7 or the second addition of liquid should be omitted. The entire amount of liquid which the particular flour in use requires and which was recorded at the first baking should be added to the sugar and yeast in the beginning in the Preliminary Fermentation Test, as directed above. Two additions of liquid are made *only* in the first test baking from each sack of flour.

FIRST KNEADING

(1) Turn the dough out on the moulding board to knead. If the correct amount of liquid has been used, the bowl will be left quite clean, and the dough can be kneaded with no flour on the board.

(2) Knead quickly until the dough is soft, smooth, velvety and elastic.

The purpose of the first kneading is (1) to mix the ingredients thoroughly and to distribute the yeast cells, (2) to develop the gluten, and (3) to incorporate air (yeast food) into the dough. This first kneading, including both mixing and kneading, requires 10 to 20 minutes, according to the skill of the kneader. Evenness and rapidity of stroke in kneading count more than strength. Avoid chilling the dough during this process.

FIRST RISING PERIOD

(1) Place the dough top-side-down in a slightly greased and warmed mixing bowl to grease the top surface, then turn the dough over.

(2) Cover closely with plate or lid to prevent the surface from drying out.

(3) Set to rise in a warm place, as in warming oven or over hot water, keeping the dough warm (80°-90°F.), until double in bulk which will require 45 or 50 minutes.

SECOND KNEADING—MOULDING

(1) Turn dough out on moulding board, again using no flour and leaving bowl clean.

(2) Knead very gently but thoroughly until the large gas bubbles are broken and small gas bubbles are evenly distributed. About two minutes for one loaf of bread is sufficient. Avoid excessive kneading at this point.

(3) Mould quickly into smooth loaf form. Proper moulding has a greater bearing on the appearance of the finished loaf made from soft flour than on that of the finished loaf made from hard flour. The dough from the soft flour does not expand so fully into a perfectly shaped loaf. Great care should be taken to form a smooth top surface and to seal all foldings of the dough on the under side. The second kneading and moulding, together, should not require longer than four minutes for one loaf.

SECOND RISING PERIOD OR RISING IN THE PAN

(1) Place the moulded dough top-side-down in a well greased and slightly warmed bread pan; turn loaf over. All surfaces will thus be slightly greased. This prevents a crust from forming on the surface of the loaf.

(2) Cover with an inverted bread pan of the same size (about 8½ x 4 x 3 for a pound loaf).

(3) Set again in a warm place to rise. Keep the dough 80° to 90° F.

(4) Let the dough rise in the pan to almost treble its bulk—requiring about 70 minutes. The length of time required for this rising period depends upon the temperature of the dough when panned and the temperature at which the dough is kept during this period. The dough, when trebled in bulk, will come a little above the sides of the pan of the size mentioned above.

BAKING

(1) Place the bread in a moderately warm oven (350°F.) for ten minutes. (See oven test on page 27.) The low initial temperature allows the dough to finish rising in the oven.

(2) Increase the heat after 10 minutes to a hot oven (400°-420°F.) Maintain this temperature 25 minutes—a total baking period of 35 minutes. Bread should continue to rise during the first 10 minutes, showing a good "spring" in the oven. The increased temperature stops the rising and prevents the bread from becoming over-light and bulging over the sides of the pan. The finished loaf should be of a golden brown color and should shrink from the pan at the end of the baking period.

COOLING AND STORING

(1) Remove bread from the pan as soon as baked.

(2) Stand it on end, across the top of the pan, or on a bread rack so that the air may get to all parts and cool it quickly. This prevents excessive drying out of the bread. Bread placed in a bread box while warm will become soggy and soon mould.

(3) Store in a tin box or stone jar and cover closely.

The entire process described in the foregoing paragraphs can be completed in 3 hours time at the most. Bread made from hard wheat flour generally requires from 5 to 7 hours, according to the number of risings allowed, even when the straight-dough process is used.

COMPARISON OF TIME REQUIRED TO MAKE BREAD FROM SOFT AND HARD FLOURS

COMPARISON OF TIME REQUIRED BY TWO TYPES OF FLOUR

Step	Soft Winter	Hard Winter or Spring	
		Two risings	Three risings
Mixing	10-20 min.	15 min.	15 min.
First rising	45 min.	135 min.	135 min.
First kneading	4 min.	5 min.	2 min.
Second rising	70 min.	100 min.	130 min.
Kneading	----------	----------	5 min.
Third rising	----------	----------	100 min.
Baking	35 min.	45-60 min.	45-60 min.
Total	164 min.—2¾ hrs.	305 min.—5 hrs.	432 min.—7 hrs.

Composition of Wheat, Flour, and Bread.—A comparison of the relative composition of spring and winter wheats, as well as of wheat, flour, and bread, is shown by the following figures:

COMPOSITION OF TWO TYPES OF WHEAT, AND OF BREAD

	Water	Protein	Fat	Carbohydrates	Ash
Wheat					
Spring varieties	10.4	12.5	2.2	73.	1.9
Winter varieties	10.5	11.8	2.1	73.8	1.8
Flour					
Minn. standard patent	10.54	11.99	1.61	75.36	.5
Bread from Minn. standard patent	34.1	9.	1.30	54.9	.7
Bread—Average of 198 analyses	35.3	9.2	1.3	53.1	1.1

Note—The basis for this table is found in "Bread and Breadmaking", Farmers' Bulletin 389, U. S. Dept. of Agr.

The composition of both wheat and flour is influenced by climate, soil, and rainfall. For this reason, the figures showing the composition vary. However, bread is approximately one-half starch, one-third water, and one-tenth protein.[6]

The foregoing table shows clearly that there are various changes which take place in converting wheat into flour and flour into bread. The greatest changes occur, however, in the conversion of flour into bread,[6] as shown in the table on page 12.

CHANGES TAKING PLACE IN BREAD MAKING

Bread is made with flour, liquid and yeast. Fat, sugar, and salt are usually added. By the addition of the liquid, the flour is converted into dough. The mixing process distributes the yeast cells through the mass of the dough. The yeast plants grow and multiply.

In the process of fermentation some of the starch of the flour is changed into sugar, and the yeast, in turn, changes some of the sugar into carbon dioxide gas and alcohol. The free escape of this gas is prevented by the tenacity of the gluten. Thus the gas causes the dough to rise. During this rising process gas cavities are formed throughout the dough. The lightness and grain of the bread depend upon the number, size and distribution of these cavities.

When the loaf is baked the heat of the oven causes the gas to expand, drives off the alcohol, and causes the protein to coagulate and set,

[6]Some points in the Making and Judging of Bread, Univ. of Ill. Bul. Vol. X, No. 25.

SOME OF THE CHANGES WHICH TAKE PLACE IN CONVERTING FLOUR INTO BREAD

Change	Agency Producing the Change
1. Formation of Gluten (Likewise dough)	1. By addition of liquid to flour.
2. Conversion of some of starch of the flour into sugar	2. By fermentation process
3. Conversion of some of sugar into carbon dioxide gas and alcohol	3. By yeast activity
4. Conversion of dough into light spongy mass full of cavities	4. By tenacity of gluten preventing escape of gas in the dough; gas is distributed throughout—creating cavities.
5. Expansion of carbon dioxide gas and yeast plants killed.	5. Heat of the oven in baking.
6. Driving off of alcohol	6. Heat of oven in baking
7. Coagulation of the protein	7. Heat of oven in baking
8. Conversion of some of starch into dextrin (brown and glazed appearance of crust).	8. Heat of oven in baking.

forming the walls of these cavities. Some of the starch is changed into dextrin thus forming the browned crust. This dextrin gives the crust a glazed appearance. There are some changes, not clearly understood, in the fat.

CHARACTERISTICS OF GOOD BREAD

Authorities agree quite generally with respect to the characteristics of a good loaf of bread. The points generally considered in judging bread are: *flavor, texture of crumb, general appearance and crust.*

Flavor ranks first in importance. Bread is made to be eaten and consequently must, above all, taste and smell good. It should have the rich, nutty flavor of the baked wheat grain.

Texture of Crumb.—There are many qualities which the crumb of good bread should have. It must look light and feel light for its size. The mesh or gas cavities should be fine and uniformly distributed. The cell walls should be thin, silky, and tender, and have a creamy color. The sides and bottom of the loaf should be free from streaks or other unevenness of texture caused by poor moulding, by chilling or drying of the surface during fermentation. The baked loaf should show such elasticity that when the cut edges are pressed together, they will spring back into place when the pressure is removed. A good loaf of bread has good keeping qualities and is palatable several days after baking.

General Appearance.—Bread should be attractive in appearance. It should be of good shape, evenly and boldly rounded on top. The crust should be smooth and unbroken, having neither breaks nor bulges. The loaf should be small enough in size that the crust will not be baked too hard in order to bake the crumb thoroughly.

Crust.—The crust should be smooth and unbroken, free from breaks or bulges. It should be crisp, pliable and tender, with an even depth of about one-eighth of an inch.

The color, whether a deep or light golden brown, should be uniform over the whole surface of the loaf. (See loaf on page 5, Fig. 2.)

Score Card for Bread*

		Points	Points
Flavor	Odor	15	
	Taste	15	
			30
Crumb	Texture	6	
	Moisture	6	
	Lightness	6	
	Color	6	
	Elasticity	6	
			30
Crust	Color	8	
	Depth	6	
	Crispness	6	
			20
General Appearance	Size	10	
	Shape	10	
			20
		Total	100

THE EFFECT OF QUALITY AND QUANTITY OF INGREDIENTS UPON BREAD MADE FROM SOFT WINTER WHEAT FLOUR

Flour.—For years, the soft winter type of flour has been considered not so satisfactory for making light bread as the hard type. However, the experiments here reported have shown that bread comparable in quality with that made from other flours can be made from soft wheat flour.

*Circular 102, Missouri Agricultural Extension Service.

Desirable bread can be made from soft winter wheat flour if the following factors are provided for:

(1) Proper Quality and Quantity of Ingredients.
(2) Proper Mixing and Kneading.
(3) Proper Fermentation.
(4) Proper Baking.

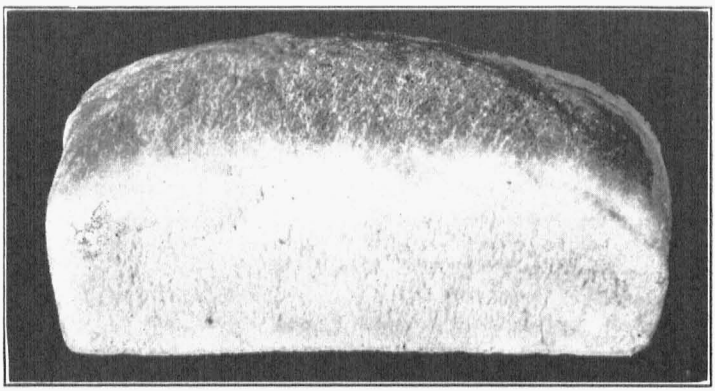
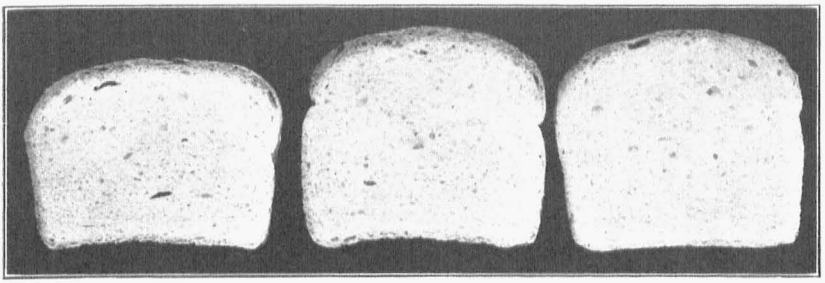


Fig. 3.—Loaf of bread made from Missouri flour by the recipe developed in this investigation.

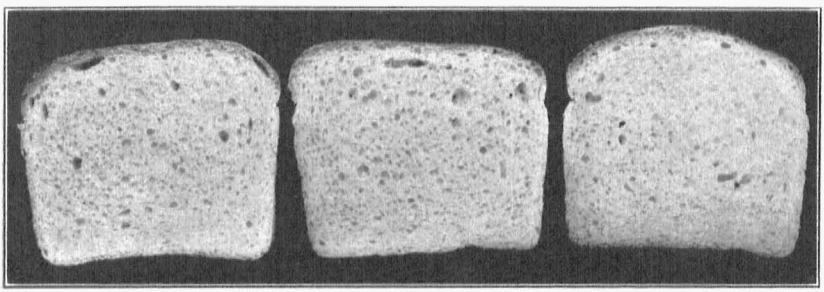
Yeast.—The usual forms of yeast are compressed yeast, dry yeast, liquid yeast from bake shops, brewers' yeast and homemade yeast in liquid, sponge or dough "starter" form. Good bread can be made from any form of yeast, provided the yeast is active and in good condition, and is kept at a proper temperature throughout the process. Compressed yeast is used by many because the required amount can be easily measured. This yeast enables the breadmaker to complete the entire process in three to seven hours. The length of time required for making bread is influenced by the kind of flour used, the number of rising periods allowed, the kind and amount of yeast, and the temperature of the dough throughout the entire process. The proper temperature, which is one of the most important factors in breadmaking, can be more easily maintained during the day while the housewife is carrying on other operations in the kitchen. For these and other reasons compressed yeast is being more and more used.

Before the recipe for the use of soft winter wheat flour in breadmaking was formulated, experiments were made to determine the proper amount of sugar, yeast, and liquid, and the method of procedure which soft wheat flour required to give the most satisfactory results.

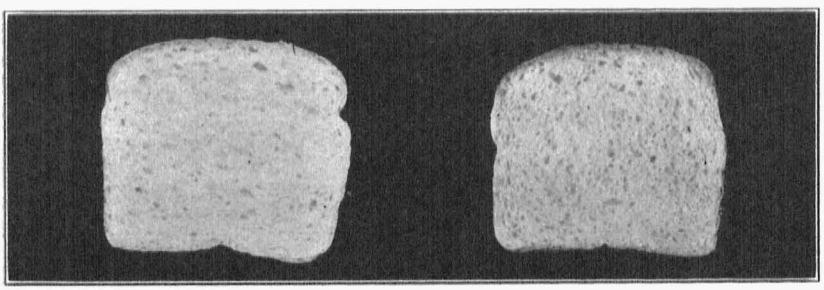
Figs. 4, 5, and 6.—Effect of Increasing Yeast (Compressed Yeast).



¼ cake (3.5 gms.) ½ cake (7 gms.) 5-7 cake (10 gms.)



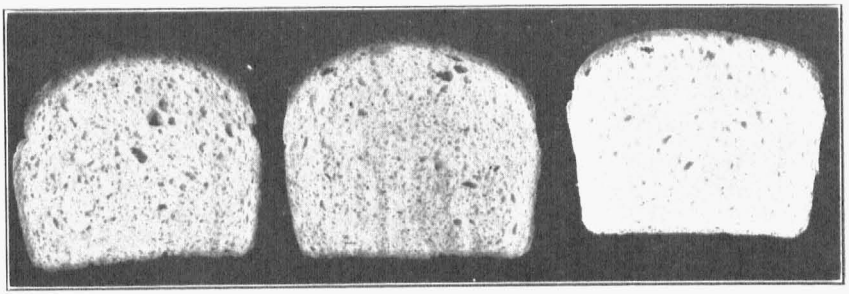
1 cake (14 gms.) 1½ cakes (21 gms.) 2 cakes (28 gms.)



3 cakes (42 gms.) 4 cakes (56 gms.)

Experiments to determine the proper quantity of yeast to use with this soft flour showed that with an increase in yeast up to two cakes per loaf, there was a corresponding increase in volume, an increase in weight

Figs. 7, 8 and 9.—Effect of Increasing Liquid. The percentages indicate the ratio of the liquid to the weight of the flour used.



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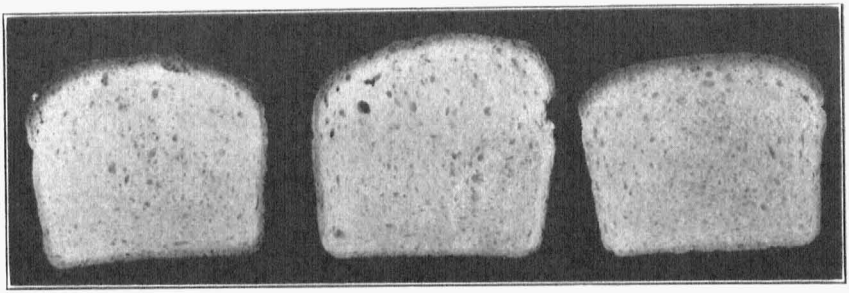

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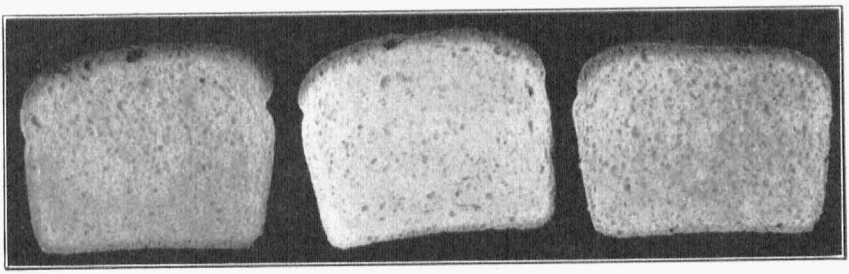


54% 55% 56%

and a decrease in the length of time of the total rising period. In these experiments the length of time required for the total rising period decreased from 4 hours and 30 minutes with one-fourth cake of yeast, to 2 hours and 20 minutes with four cakes per loaf. The maximum volume was

reached in the loaves containing one, and one and one-half cakes of yeast, respectively.

As the amount of yeast is increased the texture becomes coarser, and the crumb more and more tender and spongy until finally it is very crumbly. Yeast beyond two cakes per loaf makes the gluten of soft wheat flour so soft and elastic that it loses its capacity for holding gas and for giving the proper oven spring. The best results, in experiments in which only the amount of yeast was varied, were obtained with five-sevenths to one and one-half cakes yeast per loaf.

Common opinion seems to be that excess of yeast causes a loss of flavor, but some authorities[6] believe that the so-called yeasty flavor of bread is due to the condition of the yeast or to excess fermentation permitted by time or heat.

Liquid.—Milk, potato water and water are the liquids generally used in breadmaking. Sometimes buttermilk is used. Both milk and potato water are claimed to improve the keeping quality of bread and to contribute to the tenderness and elasticity of the crumb and the color of the crust. Sweet milk lengthens the time of fermentation or rising, while buttermilk shortens the time. However, many claim that no liquid, so far as flavor is concerned, is better than water.

More failures in breadmaking are due to the use of too small a quantity of water than to any other factor.[7]

Experiments with soft wheat flour showed that as the proportion of liquid increases, loaf volume (to certain limits) and loaf weight also increase. The texture is rather close and uneven when a small quantity of water is used, but becomes more open and uniform (to certain limits) with an increased amount of liquid, and finally becomes quite coarse and crumbly. An increase in water tends to cause the shape of the loaf to become more and more flat and "runny" and the crust pale in color. The best results with the flour used* were obtained with the use of 52 per cent water or a little over ⅔ cup to 3½ cups of sifted flour.

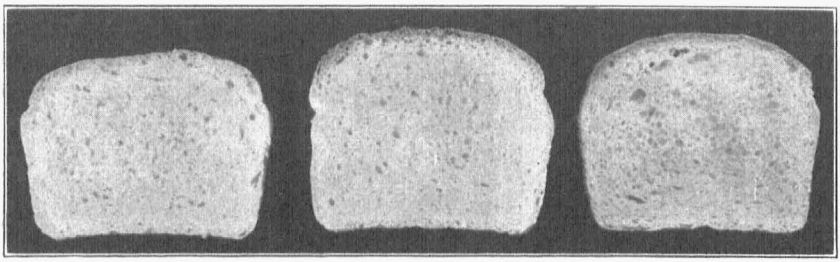
Sugar.—Sugar serves as a food for the yeast plant and so hastens the fermentation and decreases the total time of baking. Experiments showed that as the amount of sugar is increased there is a corresponding increase in loaf volume, weight of loaf and quality of texture. The oven spring is excellent when the larger quantities of sugar are used; the shape becomes a little flat as sugar "slackens" the dough; the crust browns very quickly. It becomes very deep brown in color and thick around all sides of the loaf before the bread is thoroughly baked. The texture becomes very spongy, silky and moist. However, the bread tastes of the

[7]Bul. 47, Washington Experiment Station.

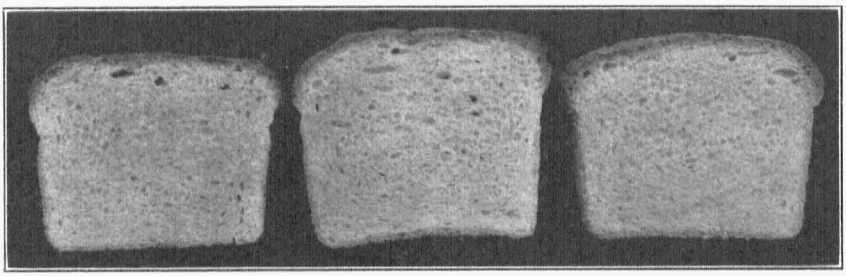
*Boone County High Patent flour from soft winter wheat of Central Missouri.

sugar when more than four teaspoons per loaf are used. For this reason alone, the use of the larger quantities in plain yeast bread is objection-

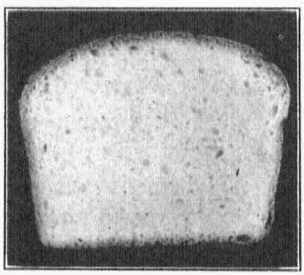
Figs. 10, 11 and 12.—Effect of Increasing Sugar.



1 tsp. (4.3 gms.) 2 tsp. (8.6 gms.) 2¼ - tsp. 10 gms.)



4 tsp. (17.2 gms.) 6 tsp. (25.8 gms.) 8 tsp. (34.4 gms.)



9 tsp. (38.7 gms.)

able. The best results with the flour used were obtained when 2½ to 4 teaspoons of sugar were used to the pound loaf of bread containing 3½ cups of sifted flour.

Summary of Results of Experiments on Variation of Proportions of Liquid, Sugar and Yeast.—In general, and to certain limits, increasing the proportion of water, sugar, and yeast causes increased volume, moistness and quality of texture of bread made from soft winter wheat flour. The small amount of gluten present in the soft type of flour seems to require the use of increased yeast and sugar, and a greater degree of slackness or softness of the dough, to bring about the desired loaf volume and the moist, spongy and open texture associated with good bread. The use of increased proportions of yeast, sugar and liquid results in a very good bread, one that can be made in a very short length of time.

Salt.—Salt produces flavor in bread but tends to lengthen the fermentation period. Within certain limits it makes the texture better, the dough nicer to handle and the crumb whiter, due to the fact that it renders the gluten tough and elastic, resulting in small cells with thin walls.[5]

Shortening.—Shortening improves all plain breads. It gives a better volume, a finer, more tender and silky texture of crumb, and a sheen and velvetiness of pile. It prevents drying and adds nourishment.

PROCESSES OF BREADMAKING

The most common methods of breadmaking are the *straight-dough process* and the *sponge process*. In the straight dough process all the ingredients are mixed at one time and the dough is made of the proper consistency before rising. In the sponge process only half the flour is used at first, with all or nearly all of the liquid, the yeast and frequently the salt and sugar. The shortening, remainder of the flour and any other desired ingredients are added after the first rising. When the dough or sponge is allowed to ferment over night, the terms "over-night straight dough," and over-night sponge" are used.

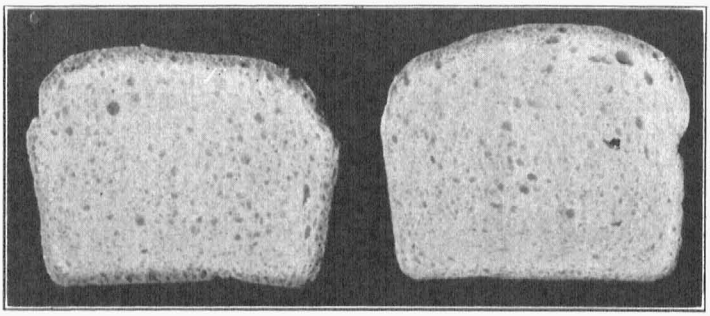
The two processes produce bread differing considerably in elasticity, grain and texture, and usually in flavor. The bread made by the long process is usually lighter to handle, more crumbly, and more porous than short process bread. Many authorities believe that it is more difficult to secure a sweet-flavored bread by the long process than by the short. Bakers also claim that the newer the dough, the better the flavor of the bread.

It does not seem advisable to use the long processes when soft winter wheat flour is used, as this flour does not stand long fermentation. Further, experiments seem to prove that the straight-dough process with *only one rising period* before the dough is panned is most satisfactory for the soft type of flour.

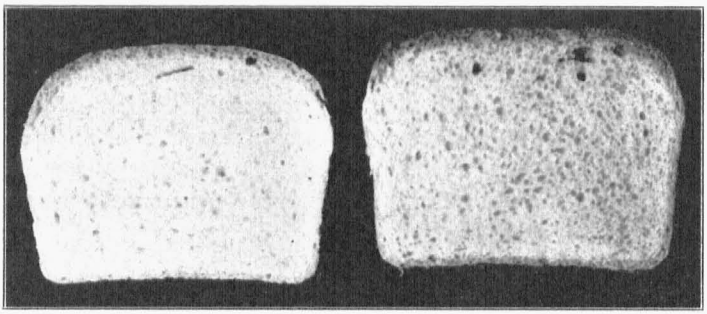
Mixing.—Proper regulation of temperature is next in importance to sound materials to insure success in breadmaking. The temperature can be properly regulated only by the use of a chemical thermometer—at

an investment of about two dollars. As yeast develops best at a moderately high temperature (77° to 95°F), the materials of the dough should be at least lukewarm. The mixing and raising should be done in a warm place, as free as possible from drafts. Too high temperatures must always be avoided as they kill the yeast plants.

Figs. 13 and 14.—Effect of Variation of Number of Risings Before Bread Was Panned.



No preliminary rising period One rising period



Two rising periods Three rising periods

Dough was allowed to treble its bulk in all rising periods before bread was panned. Dough was allowed to treble its bulk each time in the pan.

The growing yeast must be thoroughly mixed with the flour and water if all the portions of the dough are to be equally aerated by the gas from the yeast. The presence of oxygen aids in the growth of the yeast, so all parts of the dough should be exposed to the air. This is accomplished by both the mixing and kneading processes.

It is claimed by many that besides the consideration of cleanliness there is another advantage in using a bread mixer of some description. Mixing at the higher speed made possible by the use of a mixer develops the gluten and reduces the length of the fermenting period. Experiments seem to support this belief. It is certain that the mixing can be done in a mixer much more thoroughly and in less time than by hand.

The manner and length of time of mixing and kneading influence shape and texture, rather than the volume, within reasonable limits. This is especially true with respect to the first mixing and kneading periods. However, these processes differ with the various flours. Some flours seem to give best results when a thorough kneading is followed by two gentle kneadings, while with others the mere handling in the last kneading to shape into loaves gives the best results. Generally, the kneading should be sufficient to work out the large "pockets" of gas and distribute the gas and yeast thoroughly.

The best results were obtained when the dough was mixed and kneaded thoroughly about 10 minutes or 10 to 20 minutes for entire handling before the rising period. The length of time depends

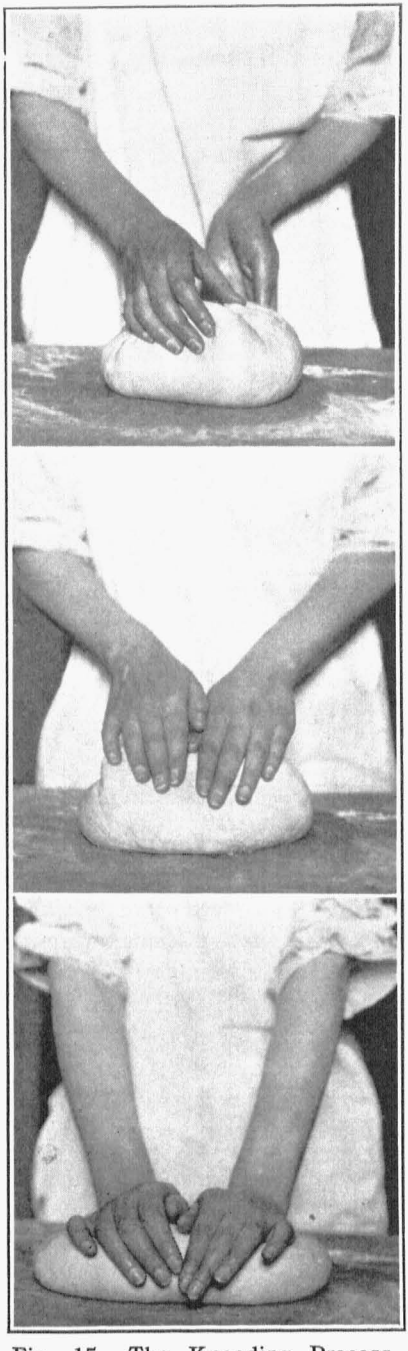
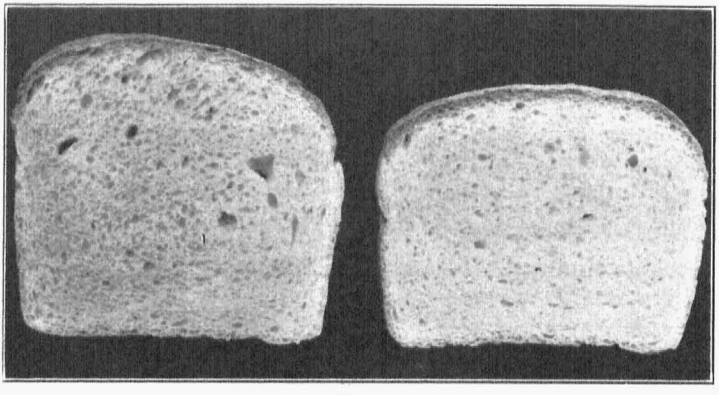


Fig. 15.—The Kneading Process.

upon the skill of the kneader and the quantity of the dough. Evenness and rapidity of stroke in mixing and kneading count more than length of time or strength. The dough should be soft, smooth, velvety and elastic; just stiff enough to hold its shape.

The best results with soft winter wheat flour were obtained when the dough was kneaded and moulded gently for not longer than three or four minutes after the first rising period and before it was panned.

Fig. 16.—Effect of Variation in Amount of Kneading. Measured by total time of kneading and moulding before bread was panned.



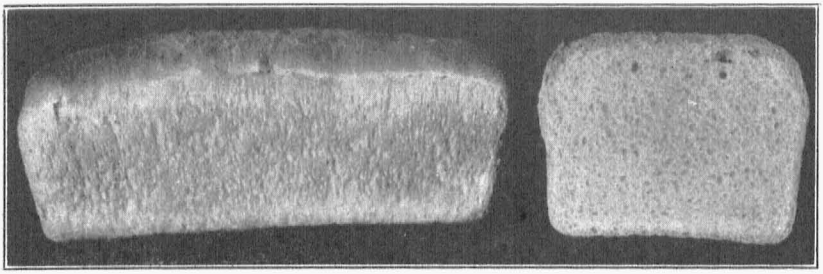
Two minutes Four minutes

First Rising or Fermentation Period.—The number of risings of the fermentation period has a very noticeable effect on shape, volume and texture of loaf. Soft winter wheat flour requires a quick fermentation period. Too short a fermentation prevents the proper development of the gluten and ripening of the dough. The result is a loaf of poor shape, usually an unsightly break the full length of one side, pale color of crust, small volume, and yellow texture. Over-fermentation gives a loaf of flat though uniform shape, poor oven spring, crumbly and coarse texture, and often poor flavor.

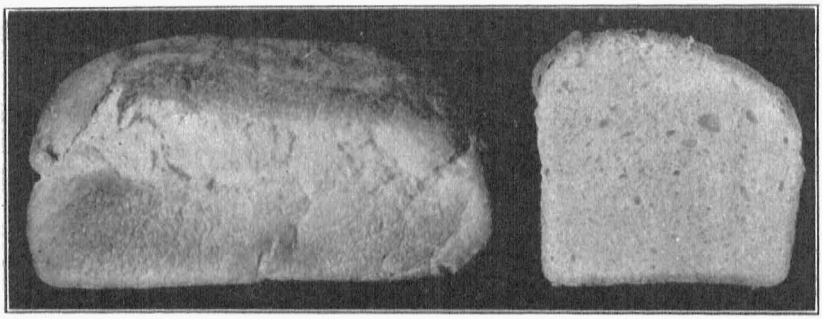
The results of numerous experiments seemed to prove that the best procedure is that of allowing the dough to double its volume once in the fermentation period or before it is panned. The importance of keeping the temperature of the dough constant during all processes cannot be over-emphasized. Chilling the dough is especially disastrous in the case of soft flour dough as this type of flour requires quick fermentation.

Second Rising or Rising in the Pan.—The treatment of the dough in the pan has the most influence not only on the size and shape, but also

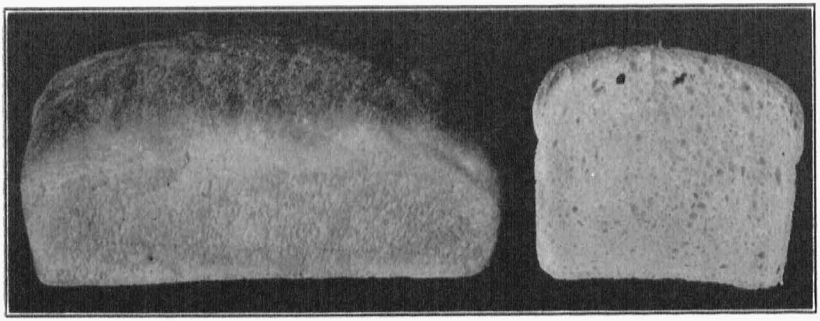
Figs. 17, 18 and 19.—Effect of Variation in Amount of Rising in First Period and Rising in the Pan.



Increased in volume by four times in first rising period.
Trebled bulk in second rising period or in the pan.

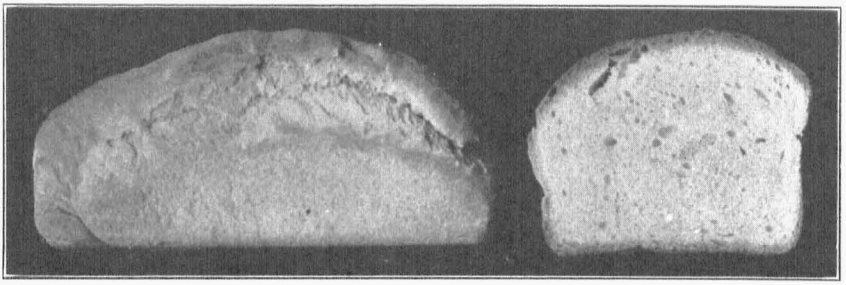


Doubled bulk in first rising period.
Doubled bulk in second rising period or in pan.



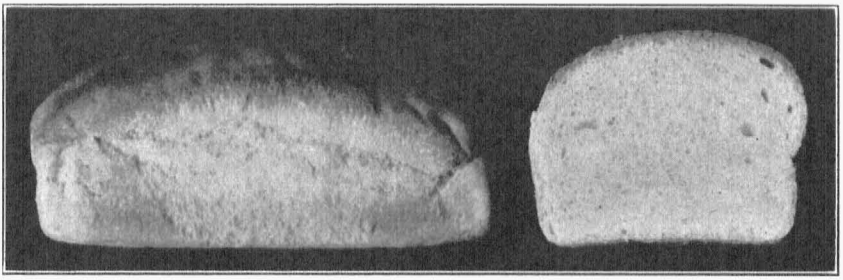
Doubled in bulk in first rising period.
Trebled in bulk in second rising period or in pan.

Figs. 20, 21 and 22.—Effect of Variation in Amount of Rising Before Dough is Panned and After Dough is Panned.



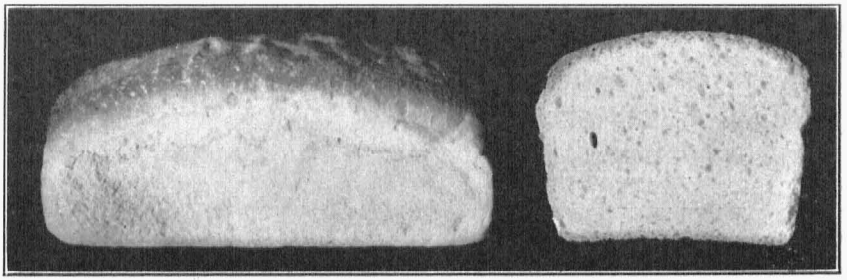
Doubled bulk, kneaded one minute, doubled bulk again before dough was panned.

Doubled bulk after dough was panned.



Doubled bulk, kneaded one minute, then trebled bulk before dough was panned.

Doubled bulk after dough was panned.



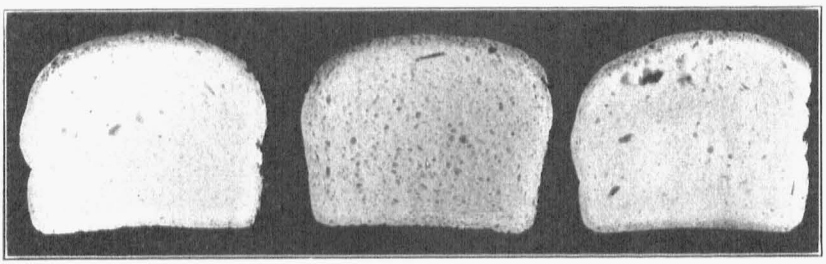
Doubled bulk, kneaded one minute then doubled bulk again before dough was panned.

Trebled bulk after dough was panned.

on the texture and grain of the final product. The general rule with bread made from hard wheat flour is that the dough should double in volume in the pan.

The results of numerous experiments with soft winter wheat flour seemed, without exception, to prove that the same rule does not hold good with this type of flour. Due, probably, to the fact that the dough from this flour is not so spongy and elastic, the dough does not expand so well nor fill the corners of the pan when allowed to rise only to double its bulk. The texture also is too fine and cakelike unless a very low oven temperature (below 350°F) is used. In this case the bread dries out too much before it has finished baking. This drying out factor must be especially guarded against when soft wheat flour is used.

Fig. 23.—Effect of Variation in Amcunt of Rising in Pan.



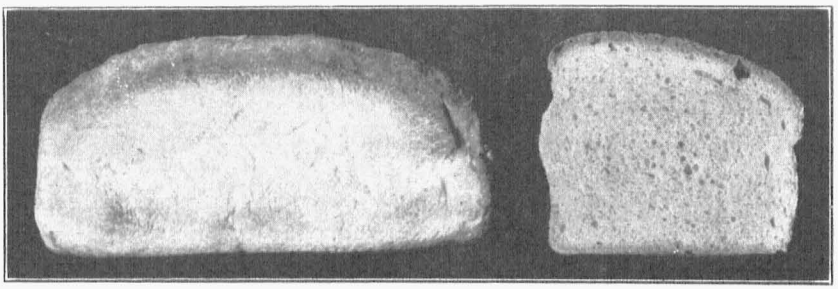
(3) (2) (1)

Reading from right. to left — (1) Bulk trebled twice before dough was panned. Bulk increased by one and three-fourths in pan. (2) Bulk trebled twice before dough was panned. Bulk doubled in pan. (3) Bulk trebled twice before dough was panned. Bulk trebled in pan.

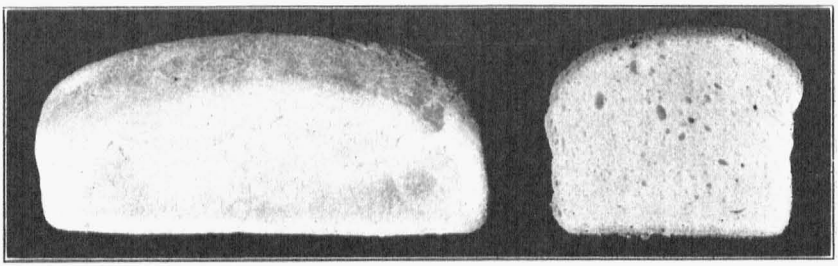
In every case when the dough was allowed only to double its bulk in the pan, even with the initial temperature quite low (350°F.), the bread rose unevenly; a break usually appeared on one side, an indication that the dough required a longer period of rising in the pan.

The results of the experiments indicated that an increase in the length of the rising period after the dough was panned, resulted in better shape, volume and texture of the loaf, within certain limits. This period should not be prolonged beyond the time required for the dough to treble its bulk. At this time the dough should give a little resistance when lightly pressed with the fingers. If the dough falls when this test is applied, it has risen too long in the pan.

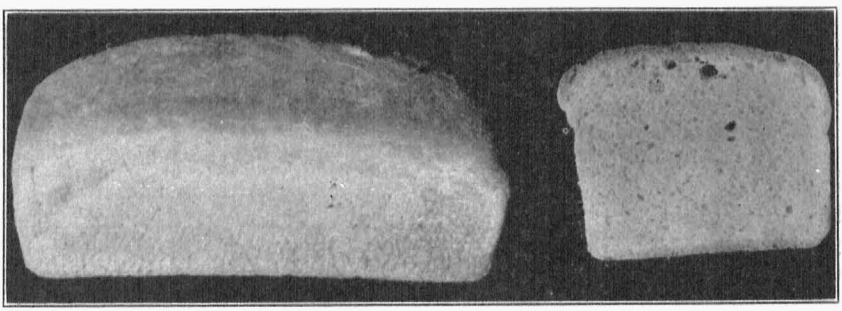
Figs. 24, 25 and 26.—Effect of Variation in Amount of Rising in Pan.



Bulk trebled before dough was panned.
Bulk increased by one and three-fourths times in pan.



Bulk trebled before dough was panned.
Bulk doubled in pan.



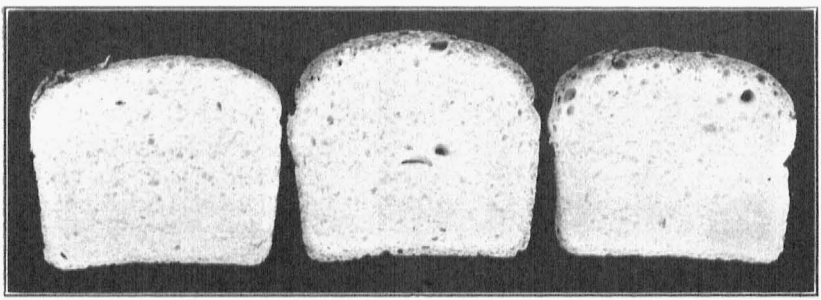
Bulk trebled before dough was panned.
Bulk increased by two and three-fourths in pan.

The best procedure appears to be that of allowing the dough to double once in the first rising period, or fermentation period, and to treble in the second rising period or the period of rising in the pan. This

method gives a loaf of large volume, good shape, and spongy, uniformly open texture.

Baking.—The best baking temperature seems to be one in which there is a low initial temperature for about 10 minutes (350°F.). When the bread is placed in the oven, the heat should be such that a crust will not form immediately and stop the rising, but the bread will continue to rise. Bread made from soft winter wheat flour is larger in size, firmer and more open in texture when allowed to finish rising in the oven, than when allowed to rise more in the pan. The oven should be evenly heated so that the rising will take place during the first 10 minutes of baking. Then increase the heat gradually until the oven is moderately hot (400-420°F.). This temperature should stop the rising and prevent the bread from getting too light and bulging over the sides of the pan. After 25 minutes of the increased heat or a total of 35 minutes for a pound loaf, the bread should be ready to be taken from the oven. Thorough baking is absolutely necessary to produce good wholesome, digestible bread. Over-baking, however, tends to cause too great a loss of moisture and makes the crumb of the bread to dry.

Fig. 27.—Effect of Variation of the Baking Temperature.

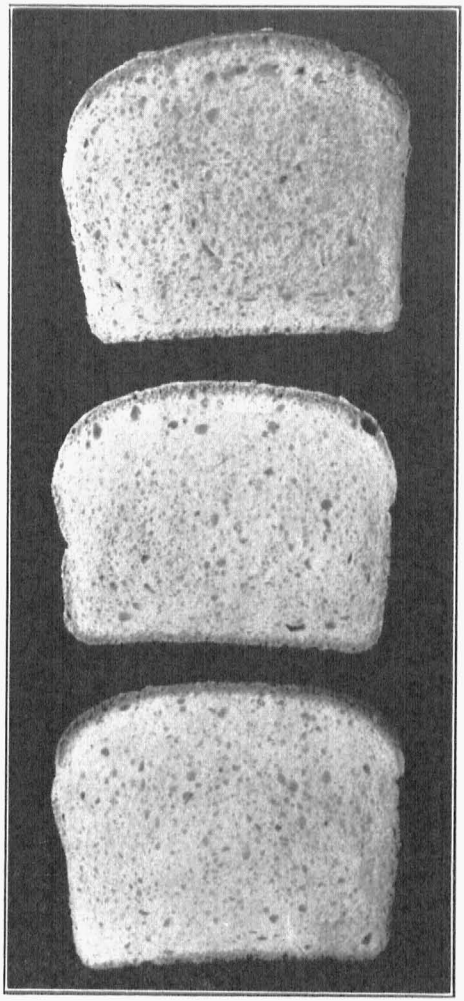


350°-410°	375°	400°
35 minutes	45 minutes	40 minutes

Oven Tests.—There is perhaps no process in which correct temperatures are more important than that of breadmaking. The best method of testing the temperature of the oven is by means of an oven thermometer. When no thermometer is at hand the flour test[8] may be used: Place ½ teaspoon of flour on a small tin lid and spread it in a layer about ¼ inch thick. Place this in the oven. If the heat is right for bread baking the flour will become creamy in tint throughout within ten minutes.

[8]Farmers' Bulletin 1136, U. S. Department of Agriculture.

Fig. 28.—Comparison of Bread Made From Hard and Soft Wheat Flours.



(1) Soft Winter Wheat Flour.
Doubled bulk before panned.
Trebled bulk after panned.

(2) Hard Winter Wheat Flour
Gold Medal.
Doubled bulk before panned.
Doubled bulk after panned.
Ordinary home method.

(3) Hard Winter Wheat Flour
Gold Medal.
Doubled bulk before panned.
Trebled bulk after panned.

To obtain best results with most bread flours the dough must be allowed to treble its bulk twice before it is panned and once after dough is panned. This requires about seven hours. Bread from Missouri flour requires not more than 3 hours to make.

BREAD PANS

It is commonly agreed that bread baked in single pans has the best quality. Single pans insure thorough baking and aid in producing a loaf of uniform shape, size and color. A pound loaf pan is a good size, about 8

by 3¾ inches at the bottom, and 9 by 5 at the top, with a depth of 3 inches.

The material of the bread pan has some influence on the final product. Experiments show that tin pans and glass pans (Pyrex) give satisfactory results, while it would appear that if either granite or sheet-iron pans are used, the oven should be at a lower temperature than with tin pans, to attain the same results. Granite or sheet-iron conducts heat more quickly and easily than does tin.

SUMMARY

Bread, from earliest history to the present day, has been considered one of the most important of all foods.

The United States ranks first in the world in the production of wheat—the national bread crop.

The two general classes of wheat, spring and winter, differ in general appearance and in composition. Hard spring and hard winter wheat flours are commonly called bread flour, and the soft winter wheat flour, pastry flour.

Missouri ranks first in the United States in the production of soft winter wheat flour, but only fifteen per cent of this flour is used within the State. The reason for this condition, is the common belief that soft flour is not desirable for breadmaking.

Recent investigation proves that Missouri soft winter wheat flour makes excellent bread, comparable in quality to that made from flour of other states.

Breadmaking, as an art and science, demands careful attention to the following essential details: (a) Quality and proportion of all ingredients, and temperature of the most essential ingredients, flour, liquid and yeast. (b) Manner and time of mixing and kneading, and temperature of the dough during these processes. (c) Time and temperature of fermentation and baking.

Authorities differ with respect to the proportion of ingredients for breadmaking. In general, it requires more sugar, more yeast, less water, but a comparatively softer dough, less kneading, a shorter fermentation period, a shorter baking period at a lower initial temperature, and from two to four hours less time to make a loaf of bread from soft winter wheat flour than is required to make a loaf of bread from hard wheat flours.

A recipe has been developed in this experiment which will give the best results with the Missouri soft winter wheat flours. (Page 10.)

The characteristics of good bread are: (a) Symmetry of size; symmetry and boldness of shape. (b) Brightness, richness and uniformity of color of crust, crispness and smoothness of crust. (c) Tenderness, elasticity, sheen, evenness of mesh, and creaminess of color of crumb. (d) The natural sweet, nutty flavor of the baked wheat grain. (e) Bread should be palatable several days after baking.

Every ingredient used in making bread, from any type of flour, influences the quality of the final product. The small amount of gluten usually present in soft winter wheat flour seems to require increased yeast and sugar, and a softer and slacker dough to bring about the desired loaf volume, and the moist, spongy and open texture associated with good bread.

Different types of flour require different methods of procedure, different time and manner of mixing, kneading, fermentation and baking. Missouri soft winter wheat flour seems to give best results when the straight dough process is used; when the dough is allowed to double its bulk in the first rising period, to treble its bulk in the second rising period or in the pan, and to finish proving in the oven, with the baking temperature ranging from 350°F. to 420°F. for about 35 minutes.

Glass (Pyrex) and tin bread pans of the pound loaf size are perhaps the most satisfactory for common use.

The total time required to make a loaf of bread from Missouri flour is from 2 to 4 hours less than is required to make a loaf of bread from hard wheat flour.

ACKNOWLEDGMENT

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

Agricultural Experiment Station