Reproducibility of 100-Gram Bread Volume as Affected by Correct-Side, Wrong-Side, or Both-Sides Break and Shred

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ABSTRACT

Laboratory bread loaves (100 g) having correct-side, wrong-side, and both-sides break and shred had average loaf volumes of 980, 994, and 962 cc and standard deviations of 12.4, 21.5, and 15.2 cc, respectively. Occurrence of correct-side breaks was enhanced (up to 100%) with proper greasing of unglazed bread pans.

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When pup loaves (100 g of flour) rise in the oven, they tend to break and shred on a particular side. When the end of a loaf is cut, the break-and-shred side will be on the left when the spiral of dough has a counterclockwise configuration (from center to exterior) after molding (loaf 1, Fig. 1). We refer to that loaf as having a correct-side break (CS). Occasionally the break and shred will be on the opposite side, and this is called a wrong-side (WS) break (loaf 2, Fig. 1). Occasionally both sides (BS) will break (loaf 3, Fig. 1).

Loaves with WS breaks have larger average volumes and deviate more than loaves with CS breaks, whereas loaves with BS breaks have smaller average volumes. Certain conditions, such as high levels of malt in no-sugar formulations, enhance the formation of WS breaks. Loaves with WS or BS breaks make crumb-grain evaluation difficult. To determine the causes of WS and BS breaks and optimum conditions for producing loaves with CS breaks, we studied various ways of coating bake pans with different amounts of shortening; panning techniques by varying the location of the dough crease in the bake pan; the effect of a high level of malt in a no-sugar formulation; and the differences between unglazed and glazed bake pans.

MATERIALS AND METHODS

Each of two composites contained flours that were milled from a number of hard winter wheat varieties grown at several locations in the Great Plains of the United States. One (CS-75A) had a protein content of 12.7% (14% mb), medium mixing requirement, and good loaf-volume potential. It was used to obtain the data in Tables I, II, and III and in Figs. 1 and 2.

The second composite (BCS-78) had a protein content of 12.2% (14% mb), medium mixing requirement, and good loaf-volume potential. It was used to obtain data in Table IV.

Shortening was a commercial vegetable product (Crisco) partly hydrogenated and having a melting point of 41°C. Bread pans having inner dimensions of 3 1/8 × 5 5/8 in. at the top, 2 1/2 × 5 in. at the bottom and 2 3/16 in. height were supplied by Ekco.

The baking procedure of Finney and Barmore (1943, 1945a, 1945b) and Finney (1945) for 100 g of flour (14% mb) with and without 6% sugar in the formula was used. When sugar was omitted, malt was increased to 3.0%. A combination of 10 ppm of potassium bromate and 80 ppm of ascorbic acid was used as oxidant for CS-75A, and 50 ppm ascorbic acid for BCS-78.

CS-75A flour was used to bake bread in unglazed bread pans that were without shortening or that were coated with shortening in several ways: adequate coat on entire inner surface (~0.18 g of shortening per pan); very thin coat on entire inner surface; adequate coat except for the top third of one side or both sides; adequate coat except for one or both ends; adequate coat on entire inner surface plus an excess on one side; and an excess all over. Glazed pans were used without shortening or with an adequate coat on the entire inner surface.

The effect of various locations of the crease (the trailing edge of the ribbon of dough after molding) on the bottom of the pan was studied. When a molded dough was held in the right hand with the curve of the trailing edge corresponding to and aligned with the curve of the fingertips, the part of the dough touching the palm was where a correct-side break would occur (side A, Fig. 3). The molded dough was placed in the pan so that the crease was at positions 1, 2, or 3 (Fig. 3).

Doughs without sugar but with 3% malted barley (54.1 dextrinizing units [DU]/g) were baked in unglazed pans with an adequate coat of shortening on the entire surface. Doughs without sugar but with 3% malt were baked in pans having an adequate coat all over except for the top third of side A, an excess on side A or B, and in pans with an excess of shortening all over. The crease was at position 3 in these cases.

The study was summarized by baking BCS-78 in unglazed bread pans coated with shortening to produce bread having CS, WS, and

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BS breaks. The shortening was, for CS, adequate all over except for one third down from the top on side A; for WS, all over except for one third down from the top on side B; and for BS, all over except for one third down from the top on sides A and B.

TABLE I
Loaves Having Correct-Side (CS), Wrong-Side (WS), and Both-Sides (BS) Breaks with Dough in a Configuration As in Fig. 3, Crease in Position 2 or 3, and Pans Greased in Various Ways

Shortening on Unglazed Pans	No. Loaves When Crease Is in Position	
	2	3
Adequate, none on top third of side B	0 CS	1 CS
	12 WS	9 WS
	0 BS	0 BS
Adequate, none on top third of side A	10 CS	10 CS
	0 WS	0 WS
	0 BS	0 BS
Adequate, none on top third of sides A and B	0 CS	3 CS
	6 WS	7 WS
	4 BS	0 BS
None	...	6 CS
	...	2 WS
	...	2 BS
Very thin all over	1 CS	4 CS
	6 WS	5 WS
	3 BS	1 BS
Excess all over	...	10 CS
	...	0 WS
	...	0 BS
Adequate all over	69 CS	69 CS
	4 WS	5 WS
	2 BS	1 BS
Adequate, none on one end	...	8 CS
	...	0 WS
	...	2 BS
Adequate, none on both ends	7 CS	10 CS
	3 WS	0 WS
	0 BS	0 BS

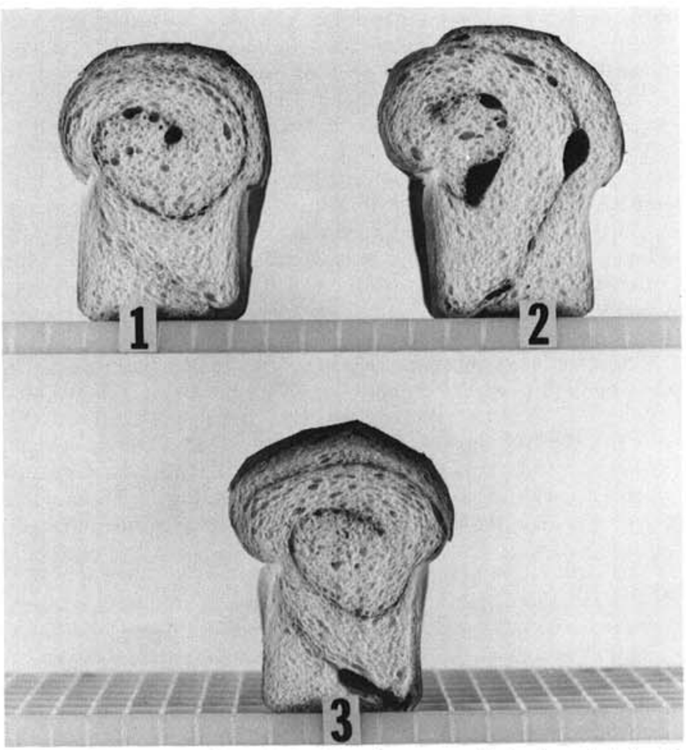

Fig. 1. Cut loaves of bread showing the counterclockwise spiral for **1**, correct-side break; **2**, wrong-side break; and **3**, both-sides break.

RESULTS AND DISCUSSION

Early experiments involving glazed and unglazed pans greased in various combinations indicated that the location of the crease in the bottom of the pan at position 1 (Fig. 3) produced 32% CS breaks and 68% WS and BS breaks. Creases at positions 2 or 3 increased the number of CS breaks to 68% and 73%, respectively. For the most part, therefore, results reported here compared creases at positions 2 and 3.

Results of baking CS-75 in unglazed pans with various combinations of greasing are summarized in Table I. Four situations greatly enhanced the probability of obtaining loaves with CS breaks: an adequate, even coat of shortening on the entire inner surface of the bread pan; an adequate, even coat except for one third from the top of side A, crease at either position 2 or 3; an adequate coat except for both ends, with crease at position 3; and an excess coat with crease at position 3.

Two of those four conditions were unsatisfactory: excess shortening because of the type of break and shred (Fig. 2, loaf 3) and because of a rapid accumulation of burned shortening in the pans; and an adequate coat except for both ends because crease location became a factor.

The most satisfactory situation was an adequate coat except for

TABLE II
Loaves Having Correct-Side (CS), Wrong-Side (WS), and Both Sides (BS) Breaks with Dough in a Configuration As in Fig. 3 and Crease at Positions 1, 2, or 3 for Glazed Pans with No Shortening, and at Location 3 for Glazed Pans Having an Adequate Coat of Shortening All Over

Shortening on Glazed Pans	No. Loaves When Crease Is in Position		
	1	2	3
None	3 CS	5 CS	0 CS
	3 WS	3 WS	9 WS
	4 BS	2 BS	1 BS
Adequate all over	...	...	10 CS
	...	...	0 WS
	...	...	0 BS

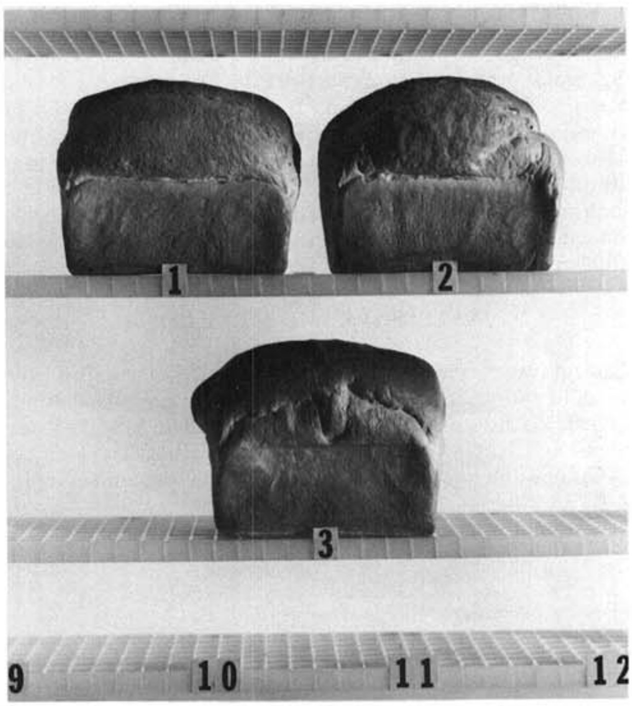

Fig. 2. Bread having typical **1**, correct-side break; **2**, wrong-side break; and **3**, overlapping breaks caused by excess shortening on bread pan.

TABLE III
Loaves Having Correct-Side (CS), Wrong-Side (WS), and Both-Sides (BS) Breaks with Dough in a Configuration As in Fig. 3 and Crease at Position 3 for Unglazed Pans Variously Greased with Shortening in a No-Sugar, High-Malt Formulation

Shortening on Unglazed Pans	No. Tests	Type of Breaks (%)
Adequate all over	15	73 CS
		27 WS
		0 BS
Adequate, none top third of side A	30	100 CS
		0 WS
		0 BS
Adequate, excess on side B	40	43 CS
		55 WS
		2 BS
Adequate, excess on side A	40	88 CS
		12 WS
		0 BS

the top third of side A. This condition has since been adopted for use in our laboratory. Although the location of the crease did not affect break type with the two favorable grease conditions, most other conditions favored the crease at position 3 and it too has since been adopted.

When glazed pans without shortening were used, an increase in undesirable breaks occurred regardless of crease location (Table II). Furthermore, glazed pans produced loaves with pitted bottoms and sides. Pitting normally occurs on loaves baked in adequately coated, unglazed pans with underoxidized (underdeveloped) doughs. Pitting from using glazed pans was therefore unsatisfactory because this visual assessment of the loaf was eliminated. A shortening coat over the glaze produced CS breaks that were similar to those of loaf 3 in Fig. 2.

High levels of malt in no-sugar formulations have favored production of loaves with WS breaks (up to 100%). Results of baking CS-75A with 3% malt and no sugar in unglazed pans coated with shortening in a variety of ways are summarized in Table III. An adequate coat except for the top third, or an excess on side A and an excess coat all over produced the highest percentage of CS breaks. Excess shortening produced on undesirable break type (loaf 3, Fig. 2).

We speculated that dough would cling to the side with no shortening one third of the way down on one side (dry side), causing more stretching and formation of break and shred. Using pans with an adequate coat all over except for an excess on one side was intended to test the theory that dough would cling more to the adequate than to the excess side, and that the break and shred would form there. For the most part, the opposite occurred (Table III). We cannot explain these results.

Mean loaf volume, standard deviation, and standard error of the mean for 30 loaves each of CS, WS, and BS breaks and for all loaves combined are given in Table IV. This verifies what has been routinely observed in the laboratory.

SUMMARY

Although pans with no shortening on the top third of one side were used in this study, a much smaller dry area produced similar results, a condition encountered in the daily routine of greasing bread pans. Too little or too much shortening also produced undesirable breaks and shreds.

TABLE IV
Number of Loaves (N), Mean Loaf Volume ($\bar{x}$), and Standard Deviation (S) for 30 Loaves, Each Having Correct-Side, Wrong-Side, and Both-Sides Breaks and for All Loaves Combined

Type of Break	Statistical Analysis N	$\bar{x}$ (cc)	S (cc)
Correct-side	30	980	12.4
Wrong-side	30	994	21.5
Both-sides	30	962	15.2
Total	90	979	21.3

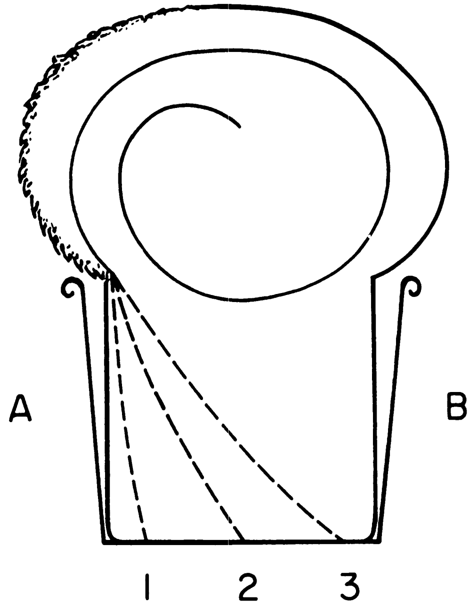

Fig. 3. Cut loaf of bread in pan illustrating configuration of molded dough after expansion and baking. Spiral line represents dough-to-dough interface. Dotted lines represent interface with dough crease at positions 1, 2, or 3.

Unglazed pans with an adequate coat of shortening except for the top third of the side where CS breaks occurred naturally, with the bottom crease opposite the CS break, produced optimum bread having the highest percentage of CS breaks and the lowest loaf-volume deviation.

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