

## OBSERVATIONS ON THE ADDITION OF CHEMICAL INGREDIENTS TO FLOUR AND BREAD

By Rae H. Harris<sup>1</sup>

A number of substances in addition to the basic ingredients of flour, water, sugar, salt, and yeast are incorporated in the modern commercial loaf of bread. These are added to the flour before it leaves the mill or to the flour or dough mix in the bakery. These additions are made with the object of producing a loaf of optimum quality and nutritive properties and increasing the period during which the bread remains fresh and attractive. There have been many discussions regarding the advisability of adding these chemical substances to a staple article of food, from the first commercial bleaching of flour to the present, when certain anti-staling compounds are under fire. Malt and various yeast foods will not be discussed here, although they are generally used in commercial baking. Malt contributes fermentable carbohydrate to the dough mix and improves the taste of the bread, while yeast foods lead to increased yeast activity during fermentation. Shortening is also commonly included; it improves the bread quality and decreases tearing and injury to the dough structure by bakery equipment.

### Flour Bleaching Agents

Flour bleaching by chemical agents has been practiced for years in the United States and Canada. The reagent is added in the form of a gas or solid to the flour in the mill before it is sacked. In addition to producing a white loaf of bread, bleaching has an "aging" or stabilizing action on the gluten. The same effect, to some extent at least, may be secured by allowing the flour to "age" under suitable conditions before baking. Chlorine dioxide is now largely used by millers for bleaching replacing nitrogen trichloride, the use of which was made illegal some time ago. There has been widespread publicity regarding possible ill effects of nitrogen trichloride on health stemming from the observation that a diet containing relatively large proportions of flour treated with this reagent induced canine hysteria in dogs. No ill effects have to date been observed in human subjects.

### Bread Enrichment Ingredients

Addition of synthetic vitamins to flour and bread is now mandatory in about 23 states, including North Dakota. The purpose behind the enrichment program is to raise the nutrient level of bread made from white flour to slightly above that of bread made from the corresponding whole wheat flour. The law passed by the North Dakota legislature in 1945 stipulates that bread contain the following additional nutrients per pound: thiamine, 1.1 to 1.8 milligrams; riboflavin, 0.7 to 1.6 milligrams; niacin, 10.0 to 15.0 milligrams; iron, 8.0 to 12.5 milligrams. The enrichment program was originally sponsored by nutritionists and scientists to aid in insuring an ade-

<sup>1</sup>Cereal Technologist.

quate diet for the American public. Full particulars of the law are given in Bulletin No. 85 published by the State Laboratories Department, Bismarck, N. D., July, 1948. There is no doubt that bread enrichment has materially raised the level of the average American diet and compensates for nutrients lost in the modern milling operation.

### Rope and Mold Inhibitors

Substances of this nature have been in use for some time in commercial bakeries, notably during the summer months, when these organisms are most active in the northern tier of states. The bread disease known as "rope" is caused by several organisms of the genus *Bacillus* which are favored by hot, humid weather. It obtained its name from the strands or ropes formed when an infected loaf is pulled apart. It develops more or less rapidly after a loaf is stored, depending on the degree of infection and storage conditions. Ropy bread emits a characteristic odor of ripe cantaloupe and has a soggy, brown colored interior, which becomes progressively worse with the age of the loaf. The most effective remedy consists in adding sodium or calcium propionate to the dough; this salt strongly inhibits the growth of the causative organism. Other preventives include the addition of vinegar to the dough, shorter fermentation, longer baking, and similar methods.

Moldy bread is familiar to everyone. It also is caused by microorganisms such as *Aspergillus glaucus*, *Rhizopus nigricans*, etc. Mold contributes a distinctive taste to bread and can be observed in dark colored patches on the crust, from which it tends to penetrate to the interior of the loaf. The infection originates on the crust of the baked loaf, since the interior has been freed from mold-producing organisms by the oven heat. The use of rope and mold preventatives has doubtless saved many loaves which would otherwise have been rendered unfit for human consumption.

### Anti-staling Agents

The incorporation of certain long-chain hydrocarbon compounds resembling fats in bread dough to retard staling rate has been advocated by a number of people. Extensive hearings have been conducted at Washington, D. C., by the Federal Security Agency to determine whether or not these substances are injurious to health. No definite decisions or rulings will be handed down for probably another year in view of the voluminous evidence presented on both sides of the question. Final bread standards will then be promulgated by the Food and Drug Administration.

Substances, such as polyoxyethylene mono-stearate, sorbitol mono-stearate, and modified esters of fatty acids, reduce the firmness of baked bread, and bread containing this material is noticeably softer after standing for two or three days than bread of similar age without it. The firmness of the loaf appears to be one of the principal properties involved in staling; at least it is the factor

chiefly concerned in the consumers' concept of staleness, and from their viewpoint this class of substances could be regarded as anti-staling agents. An opposite view would be that they function essentially as softening agents rather than as inhibitors of staling, since bread fresh from the oven is less firm when it contains them.

Usually, slightly less shortening is used when anti-staling compounds are present, since they possess some of the properties of shortening. They increase water absorption of the dough slightly and reduce the hydrophilic or water absorptive power of the starch. No harmful effect on human health has been found from incorporating anti-staling compounds in dough. At present, there is no clear-cut, definite concept of what staling really is from the technical standpoint.

The influence of the compounds discussed in this article on bread quality and consumer preferences are of especial interest to wheat producing states such as North Dakota. This is particularly true at the present time when flour consumption is declining and a large wheat surplus is feared.

#### BROMEGRASS AND CRESTED WHEATGRASS SEED PRODUCTION DOWN IN 1949

Production of both bromegrass and crested wheatgrass seed in North Dakota in 1949 was sharply lower than in any previous year. Bromegrass seed production in 1949 is estimated at 100,000 pounds of clean seed, compared to 150,000 pounds in 1948 and a five-year average of 592,000 pounds. Crested wheatgrass seed in 1949 is estimated at 80,000 pounds compared to 150,000 pounds in 1948 and the five-year average of 1,024,000.

For the U. S., 1949 production of bromegrass seed in the four commercially important states (North Dakota, South Dakota, Nebraska and Kansas) is estimated at 5,450,000 pounds, up 29 per cent over the 4,220,000 pounds of 1948 but scarcely more than half the five-year average of 10,450,000. Crested wheatgrass seed in the Dakotas, Nebraska, Montana, Washington and Wyoming is estimated at 2,550,000 pounds for 1949, slightly more than the 2,480,000 pounds in 1948, but only 36 per cent of the five-year average. (Figures compiled by C. J. Heltemes, USDA bureau of agricultural economics statistician in Fargo and his assistant, Leonard W. Orvold.)

#### NORTH DAKOTA HONEY PRODUCTION DOWN

The state's honey production in 1949 was 1,040,000 pounds, scarcely half the 1,995,000 pounds in 1948, reports the USDA bureau of agricultural economics in Fargo, C. J. Heltemes and L. W. Orvold, statisticians. In the nation, however, 1949 honey production was nearly 227 million pounds, 10 per cent more than the previous year. Leading honey state is our neighbor across the Red River. Minnesota in 1949 produced nearly 25 million pounds, while California was second busiest honey state with 22½ million pounds.

The water fern, *Marsilea*, was found last summer in Barnes county, farthest east that it has been found in North Dakota. This plant, with floating, rounded leaves of four leaflets, made the shallow water quite green at a low corner of a field near Rogers. It frequently appears in roadside ditches and was found south of Marmarth, but was very much dried up.

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