NOTE

Some Wheat and Flour Properties of Klasic—A Hard White Wheat

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ABSTRACT

Production of hard white wheat, now recognized as a class of U.S. wheats, is increasing for domestic and foreign markets, especially those in Southeast Asia for steamed breads and noodles. Klasic, an established variety, is the predominant hard white wheat grown in California. The 1988 Klasic crop had a range of wheat protein from 8.1 to 14.0%. Dough and bread properties of the flours reflected this wide range in protein. All field-run samples tested had at least 75% hard and vitreous kernels and gave near-infrared spectroscopy hardness scores above 50, supporting their classification as hard wheats. Gluten properties were strong, tough, and bucky—characteristics that could be modified by blending with Anza-type wheat, which has weak, extensible gluten.

Hard white wheats (HWW), as a recognized marketing entity, are relatively new in U.S. wheat markets. Until recently, they were grouped with soft white wheats into a white wheat class and classed as hard if 75% of the kernels were vitreous. Problems with this system were recognized several years ago, when Burt hard white wheat was grown in quantity in the Pacific Northwest (Barmore and Bequette 1968). New white wheat cultivars with hard endosperm are under development in several states, especially in California, Kansas, and Montana (Anonymous 1988, 1989a; Bequette 1988). As acreage increased and markets developed, the need for a separate class prompted the Federal Grain Inspection Service (FGIS) to propose new guidelines (Anonymous 1989b) for all white wheats in commercial markets. Final adoption of these standards has taken place and becomes effective May 1, 1990 (Anonymous 1989c).

The new standards define HWW as "all hard endosperm white wheat varieties." Classification will be based on visual examination of varietal kernel characteristics. The vitreous kernel requirement has been dropped. Rapid objective tests to replace or support visual determinations of hardness are under consideration by FGIS. Such tests include hardness by near-infrared reflectance spectroscopy (NIR), which uses the same wheat meal sample used to determine protein by NIR (Norris et al 1989). However, FGIS requires an objective, single-seed test for confirmation purposes before adopting an objective, bulk test. Currently, hardness values obtained by NIR are being used as information factors by buyers and sellers.

Most of the U.S. hard white wheat in commercial channels is grown in California and consists of one variety, Klasic, developed by Northrup-King (Plant Variety Protection in 1982). This paper describes some characteristics and functional properties of several field samples of Klasic HWW grown in 1988. It also describes the use of low-protein lots of Klasic in mixed blends with Anza-type California wheats for steamed breads, a common wheat product in Asia.

MATERIALS AND METHODS

Wheats

Wheats of Klasic variety and Anza-type (includes Anza and Yolo varieties) were collected from farms throughout California during the May to July harvest in 1988. They were stored at

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room temperature at the Western Regional Research Center and tested within a month of receipt. Duplicate 20-g aliquots of Klasic were ground on a Udy cyclone grinder for NIR hardness testing by method 39-70 (AACC 1983). NIR protein and moisture values were obtained on the same wheat meal samples. Analyses were performed on a Technicon 500 scanning monochrometer instrument.

Flours

One kilogram of each wheat sample was tempered to 14.0% moisture for 24 hr. Thirty minutes before milling, 0.5% moisture was added. Tempered wheats were milled on a Brabender Quadramat Senior mill. Break and reduction flour streams were blended for dough and bread testing. Several lots of low-protein Klasic flours were composited to provide sufficient material for further testing with flours from Anza-type wheats collected and milled in the same manner.

Farinograms and pan breads were prepared by methods 54-21 and 10-10B, respectively (AACC 1983).

Steamed breads were prepared as follows (ingredients based on total flour weight): a sponge of 80% flour, 41–45% water, and 2.5% compressed yeast was mixed and fermented for 1 hr. The dough was made by adding 10% sugar and mixing, then adding 20% flour and 2% shortening and mixing (1.5% baking powder can be added with the flour, an option used for steamed breads with fillings). The dough was divided into 250-g pieces and sheeted five or more times to develop. (A National sheeter was used in these experiments.) Dough pieces were rolled, ends cut off, and divided into two 100-g pieces. Then pieces were proofed 35 min at 86°F and 80% rh, steamed 12–15 min, and allowed to cool. Breads were refrigerated overnight in plastic bags, and then brought to room temperature before volume measurement. (Refrigeration reduces stickiness on crust, facilitating volume measurement.) Breads were weighed and volume measured by rapeseed displacement; then specific volume was computed.

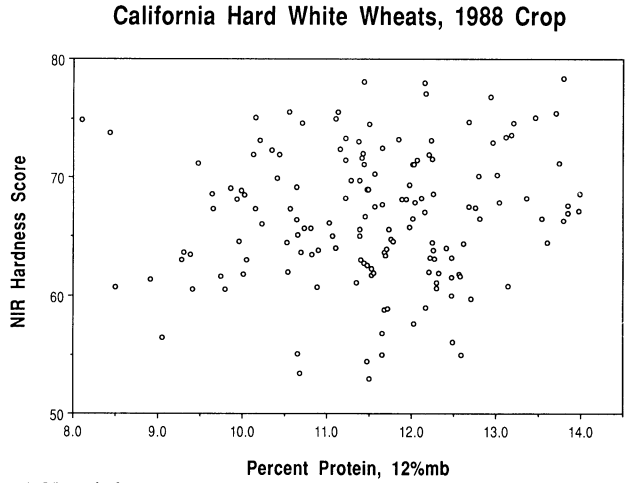

Fig. 1. Near-infrared reflectance spectroscopic hardness and protein values for 153 field samples of Klasic hard white wheat grown in California in 1988.

RESULTS AND DISCUSSION

Wheats

Figure 1 gives NIR protein and hardness scores for 153 samples of the 1988 crop of Klasic hard white wheat. Wheat protein levels ranged from 8.1 to 14.0%. Hardness scores ranged from 52.9 to 78.4. The wide range of protein content was due in part to

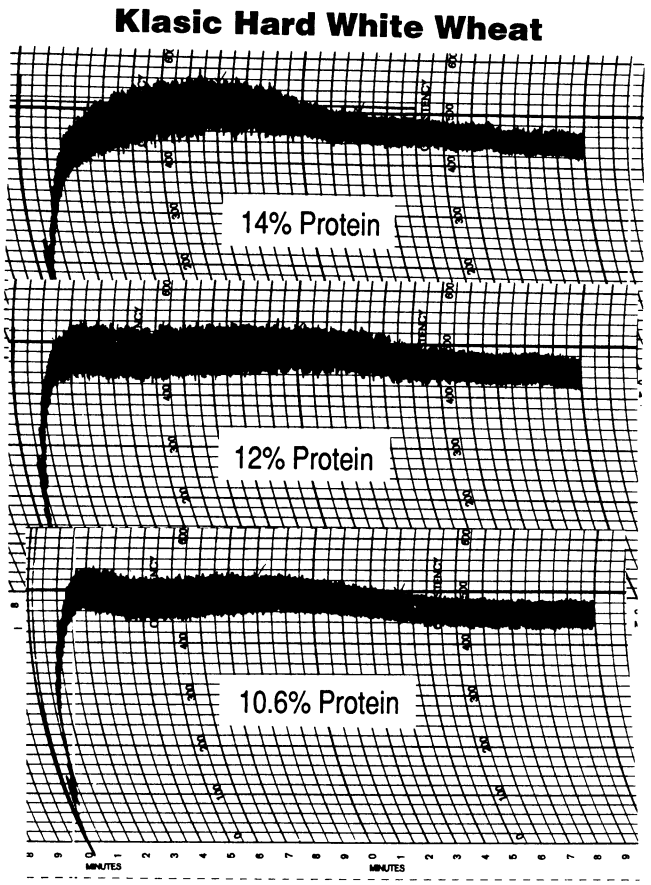

Fig. 2. Farinograms (50 g of flour) for flours from field samples of 1988 crop of Klasic hard white wheats at three protein levels (12% mb).

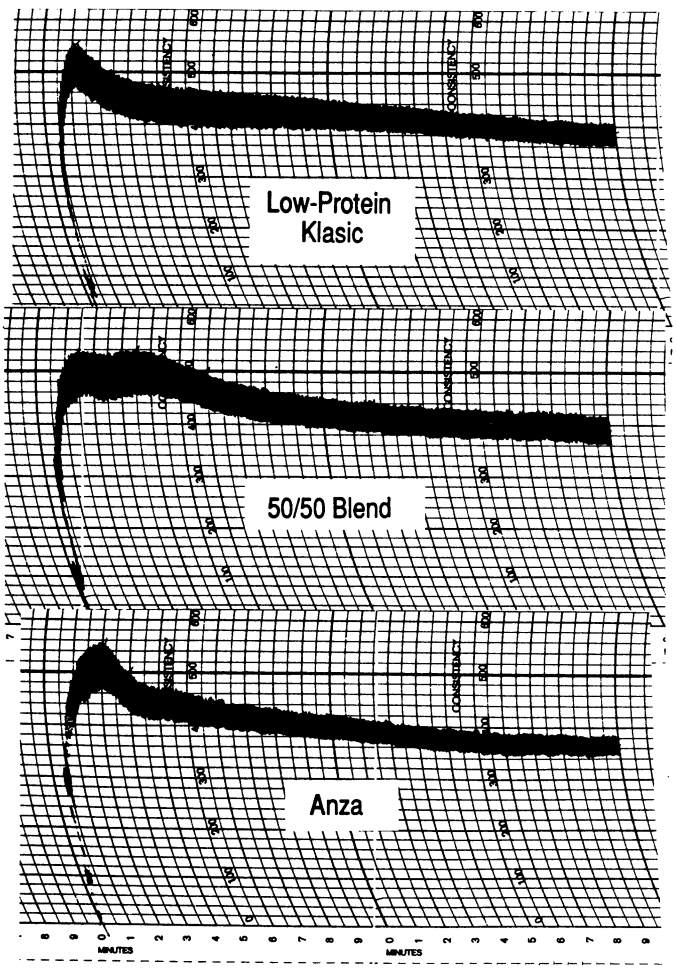

Fig. 3. Farinograms (50 g of flour) for composite flour samples from 1988 crop of low-protein Klasic and Anza-type wheats and a blend of these cultivars. Baking data are shown in Table I.

TABLE I
Some Characteristics of Low-Protein Klasic and Anza Flours and Blends

Flour	% Protein (12% mb)	Pan Bread Loaf Volume (cm^3)	Steamed Bread Specific Volume (cm^3/g)	Dough Properties
Klasic composite	9.5	705	3.06	strong, bucky, tough, rough
Anza composite	10.0	750	3.36	soft, weak, extensible
50/50 Blend of above	9.75	830	3.51	smooth, elastic

soil and climate differences throughout the wheat growing area, but more significantly to variations in cultivation practices, e.g., crop rotation patterns and irrigation levels.

In spite of the wide variation in protein content, all samples scored as hard wheats by NIR. A hardness score of 50 or above is generally considered a hard wheat. In a collaborative study (Norris et al 1989) all but one hard wheat scored above 50 and all soft wheats scored below 41. Classification of these Klasic samples as hard wheats was confirmed by FGIS grading, which indicated at least 75% hard and vitreous kernels in all samples tested under the grading standards existing at the time.

Flours

Dough mixing properties of flours were related to protein content. Figure 2 shows three farinograph curves representative of the higher protein samples. Above protein levels of 10% all Klasic samples made acceptable pan breads. Below 10% protein, doughs had shorter mixing times and breads had lower volumes. Farinograph curves resembled that shown in Figure 3 for a low-protein Klasic composite sample. At any protein level, all Klasic doughs were tough and bucky. This property could be modified by blending Klasic flours with flours from Anza-type wheats, which have characteristic weak, extensible gluten.

Figure 3 presents farinograms for composite blends of low-protein Klasic and Anza flours and a 50/50 blend of the composites, showing a synergistic effect when these cultivars are mixed. It should be noted that while the individual cultivars gave similar farinograph curves, their dough properties were very different. Klasic was bucky and Anza was extensible. Flour components responsible for these differences apparently interacted in such a way as to have a marked effect on mixing properties of the combined varieties. Such synergistic effects were unexpected. Experienced millers have noted synergy between mill streams of single lots of flour, but not between cultivars using the same mill streams, in this case, the total flour produced (*personal communication*).

Pertinent baking data are shown in Table I. Bread doughs from the 50/50 blend were smooth, easy to handle, and gave better bread volumes than breads from each cultivar alone. However, the relatively weak nature of the dough, compared with doughs from American bread flours, would probably prevent its use in automated commercial bakeries. Nevertheless, it proved satisfactory for steamed breads, which are made in small establishments with considerable manual labor. The flours of choice in these bakeries often have properties similar to our soft wheat flours.

Steamed Breads

The steamed bread formula given in Materials and Methods is a laboratory adaptation of a small bakery method used in Asia. It is a short-time, low-absorption, sponge dough, using 80% of the flour in the sponge. At dough mixing, baking powder, an optional ingredient, is added to doughs that will contain meat, vegetable, or other fillings. This treatment gives more uniformity to crumb structure in the filled steamed bread products.

Steamed bread doughs are developed by sheeting. Tolerance of doughs to several sheetings reflects dough strength properties that maximize steamed bread volume. Sheeting tolerance is often used to evaluate dough properties for steamed breads in the same manner as mixing time experiments are used for conventional pan bread flours.

Conclusions

A Klasic and Anza 50/50 flour blend gave improved dough and steamed bread properties compared with those for either flour tested alone. The successful combination of low-protein Klasic and low-protein Anza-type wheats has prompted the California Wheat Commission to promote a market for a "California Blend" of these wheats in 40/60, 50/50, and 60/40 mixtures.

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