

## Evaluating Noodle Quality of CPS Wheat: Color Aspect

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### INTRODUCTION

Noodles account for 30-55% of wheat consumption in Asian countries (Chen 1993). Although Canada has been one of the major suppliers providing high quality wheat for bread market in the world, its share in the noodle market is relatively low. At the present time, there is no noodle wheat variety in North America although efforts have been made to develop such varieties in the United States and Canada in recent years.

Flours used for the production of Asian noodles require different characteristics from those used for Western style pasta and baked bread (Nagao 1996). The appearance (color and brightness in particular), in addition to texture, is the predominant factor in determining the acceptance of a wheat variety for Asian noodles (Kruger et al 1992). Therefore, color evaluation is of particular importance in breeding noodle wheat (Kruger et al 1992; Morris et al 1998).

CPS class, especially the white kernelled class, have a medium hard texture, gluten strength and protein content with higher flour extraction rate (De Pauw 1995). These characteristics meet quality requirements of Asian noodles better than the Hard Red Spring wheat class, and efforts have been made to develop CPS white varieties with improved quality characteristics in the University of Saskatchewan and elsewhere in Canada. The present study was undertaken to investigate noodle quality of CPS genotypes with the emphasis on color aspect. The ultimate goal of this research is to develop simple indices for screening of breeding lines suitable for noodle manufacturing.

## **MATERIALS AND METHODS**

### **Materials**

Registered cultivars, Genesis, AC Karma and AC Vista, and 17 CPS breeding lines were grown at the Kernen Research Farm (University of Saskatchewan, Saskatoon, SK), Swift Current (Agriculture and Agri-Food Canada Research Station, Swift Current, SK) and Watrous in 1997 and 1998. Mature grain were harvested and cleaned for color and chemical analysis and noodle making. Grain color was measured using the HunterLab MiniScan reflectometer (HunterLab Laboratory Inc.) and protein determined by NIR analysis (AACC Approved Method 39-25). A small portion of grain was ground in Udy Cyclone mill to pass a 0.5-mm screen for the determinations of color of ground samples and total nitrogen (AACC Approved Method 46-13). Ground samples were also used to prepare noodle sheets for color evaluation.

Standard flours, one for white-salted noodles and one for yellow-alkali noodles, obtained from Nisshin Flour Mill, Tokyo, Japan were used for comparison.

A Brabender Quadrumat Jr. laboratory mill was used to mill 100 g of CPS samples which were tempered to 14.5% moisture (AACC Approved Method 26-50) prior to milling. Flours were used for determinations of color (HunterLab MiniScan), protein (AACC Approved Method 46-13) and ash (AACC Approved Method 08-03) contents. Albumins, globulins, gliadins and glutenins were consecutively extracted from flour (1 g) with 50 ml of double distilled water, 50 ml of Na-phosphate buffer (0.05 M, pH 6.5) containing 0.1 M NaCl, 50 ml of 70% ethanol (v/v), 50 ml of 0.05 M borate buffer (pH 8.5) containing 2% (w/v) SDS and 2% (v/v) 2-mercaptoethanol, respectively (Martinan et al 1998).

### **Noodle preparation**

A commercial coffee grinder (Bosch MKM 6000 UC, BSH Home Appliances Broadview, IL) and a home-style manual noodle machine (Atlas Pastabike, OMC Marcato, Campodarsego, Italy) were used to prepare noodles using 10 g wheat flour.

Following industrial procedures (Nagao, 1996), a small-scale procedure was developed for the evaluation of noodle quality. Briefly, 10 g of flour or wholemeal sample contained in a 50-ml plastic container was hand-mixed for 10 sec with a spetula after the addition of salt or alkali solutions. The course dough was transferred into a commercial coffee grinder, mixed for 10 sec then placed in a closed container for 15 min to ensure uniform moisture distribution. The mixture was transferred to dough-forming containers and passed through rollers at #2 setting for a few times. After resting in a closed plastic bag in the dark for 30 min, the dough sheet was successively passed through #2, #3, #4 and #5 roller gaps once per roller gap without changing direction to reduce dough thickness. Four 5-cm noodle sheets were obtained from each sample, 2 sheets were used for color evaluation without cooking (raw). The remaining 2 sheets were cooked in 500-ml of boiling water for 5 min followed by immediate cooling in running water bath for 2 min. The color of either cooked or raw noodle sheets was determined after 0 hr, 2 hr and 24 hr storage at room temperature in closed plastic bags in the dark. Alkali noodles were prepared using 10.0 g flour or ground meal (14% moisture) and 3.50 ml (for flour) or 4.00 ml (for wholemeal) kansui containing 0.9% (w/v)  $\text{Na}_2\text{CO}_3$  and 0.1% (w/v)  $\text{K}_2\text{CO}_3$ . For the preparation of white-salted noodles, 3.50 ml (flour) or 4.00 ml (wholemeal) salt solution ( $\text{NaCl}$ , 8.6% for flour and 7.5% for wholemeal, w/v) was mixed with 10.0 g of flour or wholemeal samples. Chemical analyses were repeated 4 times and noodle test twice for each sample. The results were subjected to regression analysis using Minitab statistical software.

### **L-DOPA PPO Activity**

The method of Morris et al (1998) was applied for the determination of PPO (polyphenol oxidase) activity of CPS wheat. Five kernels of wheat were contained in a 2-ml microfuge tube to which 1.5 ml of 50 mM MOPS buffer (pH 3.5, pH 6.5) containing 5 mM of L-DOPA was added. The tubes were placed on the sedimentation mixing rack (AACC Approved Method 56-61A) to allow thorough mixing of air bubble enclosed in the tube with the kernels and the solution. After incubating the tubes at room temperature ( $\approx 23^\circ\text{C}$ ) for 30 min, approximately 1 ml of the solution was sub-sampled and absorbance

read at 475 nm. PPO activity was done in quadruplicate for each CPS sample and results were subjected for analysis of variance and correlation with noodle color data.

## RESULTS AND CONCLUSION

Multiple regression analysis indicated that L-value and yellow index, measured by HunterLab MiniScan reflectometer, were the most useful parameters in evaluating color of both flour and noodle samples. Whiteness and yellow index of flours obtained by milling CPS wheat in Quadrumat Jr. experimental mill at 70-75% extraction showed higher correlations with those of ground samples than those of intact grain. This result suggested that screening based on grain color may result in bias in predicting flour color of CPS wheat. Color measurement on ground sample (wholemeal) is recommended for screening of breeding lines.

For both yellow-alkali and white-salted noodles, standard flours exhibited higher brightness and lower yellow index, probably due to lower flour extraction rates, compared to CPS flours. For both standard and CPS flours, brightness of raw noodles decreased while yellowness increased dramatically in the first 2 hr after preparation. For cooked noodles, however, brightness increased while yellow index decreased during 24 storage at room temperature. Compared to the standard flours, CPS wheat showed larger changes in brightness and yellow index for either raw or cooked noodles. The color of wholemeal noodle showed no correlation with the color of noodles made of flour. In contrast, a good correlation ( $r=0.68$ ,  $p<0.01$ ) was found between flour color and noodle color for both white-salted and yellow-alkali noodles, either raw or cooked. Seed polyphenol oxidase (PPO) activity assayed using L-DOPA and MOS buffer at pH 3.5 showed a high correlation ( $r=0.78$ ,  $p<0.01$ ) only with noodle brightness of raw white-salted noodles. Gluten content of CPS wheat showed a negative correlation ( $r=-0.51$ ,  $p<0.05$ ) with the brightness and a positive correlation ( $r=0.58$ ,  $p<0.05$ ) of cooked yellow-alkali noodles. These results indicate that wholemeal color, PPO activity and gluten content are useful indices for the evaluation of noodle color for CPS wheat.

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