Wheat Quality Evaluation Methods

All results are corrected to a 13.5% moisture basis (mb) for wheat and a 14.0% mb for flour or semolina unless otherwise specified. AACCI Methods are from the American Association of Cereal Chemists International: Approved Methods of Analysis, 11th Edition.

ALVEOGRAPH — AACCI METHOD 54-30.02

Alveograph values are determined using the AlveoLab and light mineral oil according to AACCI Method 54-30.02. Samples are evaluated one week after milling. The following curve parameters are measured: P (height x 1.1) is the resistance of the dough to deformation; L (length) is a measure of dough extensibility; P/L is the curve configuration ratio; W is the amount of work required to inflate the dough into a bubble; Ie (elasticity) measures the ability of the dough to return to its original shape; G (swelling) relates to the volume of air necessary to inflate the bubble until rupture.

AMYLOGRAPH — AACCI METHOD 22-10.01

Amylograph peak viscosity is determined using a Viscograph-E according to AACCI Method 22-10.01 with modifications. Flour (65 g, 14% mb) and distilled water (450 mL) are placed in a bowl, mixed with a whisk and then added to the amylograph.

ASH — AACCI METHOD 08-01.01

Ash content is determined using AACCI Method 08-01.01. Samples are weighed into previously dried dishes (600°C, minimum of 1 h). The samples are then incinerated overnight in a muffle furnace (600°C).

BAKING, PILOT – NO TIME DOUGH (NTD) — CIGI INTERNAL METHOD

White pan bread is processed in Cigi's pilot bakery using a No Time Dough baking method based on formulation and processing conditions which simulate commercial practices and use commercial equipment. All ingredients are placed in a spiral mixer and mixed on slow speed (2 min) and then on second speed until the dough is fully developed. The dough is then rested on the bench (10 min), scaled into pieces (640 g) and rounded. The dough balls are rested (10 min), shaped using a commercial B&B molder, panned and fully proofed. The samples are baked in a Picard reel oven (200°C, 26 min).

BAKING, PILOT – SPONGE & DOUGH — CIGI INTERNAL METHOD

White pan bread is processed in Cigi's pilot bakery using a Sponge & Dough baking method based on formulation and processing conditions which simulate commercial practices and use commercial equipment. The sponge portion (flour, water, yeast, yeast food) is placed in a spiral mixer and mixed. After mixing, the sponge is proofed (4 h) in a proofing cabinet. To prepare the dough, the fermented sponge and the remaining ingredients are placed in a spiral mixer and mixed on slow speed (2 min) and then on second speed until the dough is fully developed. The dough is then rested on the bench (10 min), scaled into pieces (640 g) and rounded. The dough balls are rested (10 min), shaped using a commercial B&B molder, panned and fully proofed. The samples are baked in a Picard reel oven (200°C, 26 min).

BAKING, TEST – NO TIME DOUGH (NTD) — CIGI INTERNAL METHOD

Test baking using a No Time Dough method is based on AACCI Method 10-10.03 with modifications. All ingredients are placed in the bowl of a water-jacketed National Manufacturing Swanson pin mixer (20°C, 112 rpm) which is controlled with software to measure mixing time (min) and energy (W) input. The dough is mixed 10% past peak time and then placed in a covered bowl and allowed to rest (10 min, room temperature). The dough is scaled (165 g), rounded by hand and allowed a second rest (10 min, room temperature). The dough is then sheeted, molded, panned and proofed (37°C, 85% RH) to a fixed height. Samples are then baked in a National MFG. Co. reel oven (204°C, 20 min).

BAKING, TEST – LONG TIME FERMENTATION (LTF) — CIGI INTERNAL METHOD

Test baking using a Long Time Fermentation method is based on AACCI Method 10-10.03 with modifications. All ingredients are placed in the bowl of a water-jacketed National Manufacturing Swanson pin mixer (15°C, 112 rpm) which is controlled with software to measure mixing time (min) and energy input (W). The dough is mixed 10% past peak time and then scaled, rounded, and allowed to rest in a fermentation cabinet (37°C, 85% RH; 105 min). After the initial fermentation, the first punch is performed by sheeting, tri-folding and placing the dough back into the fermentation cabinet for a second rest period (37°C, 85% RH; 50 min). The second punch is handled the same way as the first punch and the dough is placed back into the fermentation cabinet (37°C, 85% RH; 25 min). After 180 minutes of total fermentation time, the dough is sheeted, molded, panned and proofed (37°C, 85% RH) to a fixed height. Samples are then baked in a National MFG. Co. reel oven (204°C, 20 min).

BAKING – TOTAL BREAD SCORE — CIGI INTERNAL METHOD

Pan bread, baked in Cigi's test or pilot bakeries is subjectively scored using an internal method to obtain the Total Bread Score. Total bread score is comprised of external loaf characteristics (symmetry, crust character, crust colour, and break and shred) and internal crumb characteristics (crumb colour and crumb structure).

COLOUR – BREAD CRUMB — CIGI INTERNAL METHOD

Assessment of the crumb colour of a bread slice is performed using the Minolta CR-400/410 colorimeter (D65 illuminant, 2° standard observer angle) according to manufacturer's instructions. Two slices of bread are placed on the light projection tube and the measurement is taken. L* values (0 = black to 100 = white), which indicate the brightness of the crumb, are recorded.

COLOUR – FLOUR (WET) — CIGI INTERNAL METHOD

Assessment of flour colour is performed using the Minolta CR-410 colorimeter (D65 illuminant, 2° standard observer angle) according to manufacturer's instructions. A slurry of flour and water is made according to AACCI Method 14-30.01 with respect to flour weight, volume of water, mixing time and waiting time. Samples are evaluated one week after milling. The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = redness); b* (-b* = blue to +b* = yellow).

COLOUR – NOODLE — CIGI INTERNAL METHOD

A Minolta CR-410 colorimeter (C illuminant, 2° standard observer angle) is used to measure the colour of a noodle dough sheet (see Noodle Processing for details). The dough sheet is folded into six layers and stored in a covered container at room temperature (22 ± 1°C, 24 h). The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = redness); b* (-b* = blue to +b* = yellow). The average of five colour measurements, taken at five spots on the dough sheet surface at 3 and 24 h after mixing, are reported.

COLOUR – SEMOLINA (DRY) — CIGI INTERNAL METHOD

Assessment of semolina colour is performed using the Minolta CR-410 colorimeter (D65 illuminant, 2° standard observer angle) according to manufacturer's instructions. Semolina is placed in a granular material attachment and a measurement is taken. Samples are evaluated one week after milling. The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = redness); b* (-b* = blue to +b* = yellow).

COLOUR – SPAGHETTI — CIGI INTERNAL METHOD

A Minolta CR-410 colorimeter (D65 illuminant, 2° standard observer angle) is used to measure the colour of dried spaghetti strands (see Spaghetti Processing for details). Strands are mounted on standard white cardboard (7.5 cm x 7.5 cm) using double sided tape. The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = redness); b* (-b* = blue to +b* = yellow).

EXTENSOGRAPH — AACCI METHOD 54-10.01

Extensographs are performed using the Extensograph-E according to AACCI Method 54-10.01 with the modification that the dough test pieces are not stretched at 90 min, only re-formed. Results are reported for the stretches completed at 45 and 135 min. The Extensograph-E is calibrated so that a 100 g load is equivalent to 80 BU. Samples are tested one week after milling. The following parameters are measured: R_{max} is the maximum height (maximum resistance) of the curve; E is a measure of the extensibility in mm; A is the area under the curve in cm^2 (energy).

FALLING NUMBER (FN) — AACCI METHOD 56-81.03

Falling number is determined using the FN1000 with the Shakematic 1095 according to AACCI Method 56-81.03. For evaluation of wheat FN, a sample of wheat (minimum of 250 g) is ground using the FN3100 laboratory mill with 0.8 mm screen.

FARINOGRAPH — AACCI METHOD 54-21.02

Farinographs are performed using the Farinograph-E or Farinograph-AT with either the large (300 g) or small (50 g) bowl according to AACCI Method 54-21.02. Flour is tested one week after milling. The following parameters are measured: water absorption (FAB) is the amount of water needed to center the curve on the 500 BU line at maximum consistency (peak); dough development time (DDT) is the time for the dough to reach maximum consistency (peak); stability is the amount of time that the top portion of the curve is above the 500 BU line; mixing tolerance index (MTI) is the drop in BU of the top of the curve at DDT to the top of the curve 5 min after DDT.

FLOUR YIELD – LAB MILLING — CIGI INTERNAL METHOD

Wheat for milling is cleaned using a dockage tester with standard screens and then tempered overnight based on wheat class: hard wheats (i.e. CWRS; 16.5% moisture); medium hard wheats (i.e. CPSR, CWRW; 16.0% moisture). Milling is done using a Bühler laboratory flour mill (MLU-202) using preset feed rate and roll gap settings for each wheat class. After milling, the bran and shorts fractions are put through a Bühler bran finisher (MLU-302) and any additional flour released is added to the original flour and used for calculation of the final flour yield.

GLUTEN CONTENT & GLUTEN INDEX (GI) — AACCI METHOD 38-12.02

Wet gluten content and gluten index values are determined using the Glutomatic 2200 with the Gluten Index Centrifuge 2015 according to AACCI Method 38-12.02. The single-stage washing procedure is used for flour while the two-stage washing procedure is used for semolina/ground wheat. Flour/semolina samples are tested one week after milling.

GRANULATION — AACCI METHOD 66-20.01

Semolina granulation is determined using a Ro-tap sieve shaker according to AACCI Method 66-20.01.

MIXOLAB — AACCI METHOD 54-60.01

Mixolab assessment is determined using the Mixolab 2 according to AACCI Method 54-60.01. Flour is tested one week after milling. The following parameters are measured: water absorption (WA) is the amount of water needed to form dough with a consistency of 1.1 ± 0.05 Nm on the C1 torque; C1 torque (C1) is initial peak dough consistency; time to T1 (T1) is the time needed to reach C1; Stability is the time around C1 where the torque > C1-11%; C2 torque (C2) represents the lowest point of the curve; C3 torque (C3) is the maximum torque obtained after C2 during the heating phase ; C4 torque (C4) is the minimum torque obtained after C3 (appears only if a decrease is measured after C3); C5 torque (C5) is the torque at the end of the test.

MOISTURE CONTENT – GROUND WHEAT/FLOUR/SEMOLINA — AACCI METHOD 44-15.02

The moisture content of ground wheat/semolina/flour is determined according to AACCI Method 44-15.02 using the single stage procedure (130°C, 1 h).

MOISTURE CONTENT – WHEAT — AACCI METHOD 44-11.01

The moisture content of whole kernel wheat is determined using the Perten AM5200-A according to AACCI Method 44-11.01.

NOODLE PROCESSING – INSTANT — CIGI INTERNAL METHOD

Flour is processed into instant noodles using an Ohtake vertical mixer. Salt (NaCl; 1% based on flour weight), alkaline salts (K_2CO_3:Na_2CO_3 = 5:5 w/w: 0.1% based on flour weight) and guar gum (0.2% based on flour weight) are dissolved in water and added to flour at a constant water absorption (34%, 14% mb, mass balanced) and then mixed (100 rpm, 10 min). The noodle sheets are prepared using Cigi's pilot Ohtake noodle line starting with an initial gap setting of 5.1 mm. The dough sheet is then subjected to four reduction passes (2.0, 1.5, 1.2, and 1.0 mm) and cut into noodle strands at the final pass. The cut noodle strands are continually fed into a traveling net conveyor. The cut noodles are cooked with steam while passing through a tunnel steamer. Noodles are then cut into a predetermined length to make one serving size. The noodle portions are deep-fried in a tunnel fryer and then cooled to room temperature in a cooling tunnel.

NOODLE PROCESSING – WHITE SALTED NOODLES (WSN) — CIGI INTERNAL METHOD

Flour is processed into white salted noodles using an Ohtake vertical mixer. Salt (NaCl; 2% based on flour weight) is dissolved in water and added to the flour at a constant water absorption (32%, 14% mb, mass balanced). The dough is mixed (100 rpm, 10 min) and then rested (15 min). Sheeting begins with an initial gap setting of 3.5 mm and then the dough sheet is folded, sheeted again and rested (30 min). The dough sheet is subjected to four reduction passes (2.0, 1.5, 1.2, and 1.0 mm). A section (100 cm) is cut from the noodle sheet for colour evaluation (see Colour – Noodle for details). The remaining dough is sheeted a final time before cutting. The final gap setting is adjusted for each sample to ensure the resulting noodle strands have a thickness of 1.4 mm. Noodle strands are cut using a No. 10 or No. 20 cutter to produce noodles with a width of 3.0 or 1.5 mm, respectively.

NOODLE PROCESSING – YELLOW ALKALINE NOODLES (YAN) — CIGI INTERNAL METHOD

Flour is processed into yellow alkaline noodles using an Ohtake vertical mixer. Salt (NaCl; 1% based on flour weight) and alkaline salts (K_2CO_3:Na_2CO_3 = 6:4 w/w: 1.3% based on flour weight) are dissolved in water and added to flour at a constant water absorption (34%, 14% mb, mass balanced). The dough is mixed (100 rpm, 10 min) and rested (15 min). Sheeting begins with an initial gap setting of 3.5 mm and then the dough sheet is folded, sheeted again and rested (30 min). The dough sheet is subjected to four reduction passes (2.0, 1.5, 1.2, and 1.0 mm). A section (100 cm) is cut from the noodle sheet for colour (see Colour – Noodle for details). The remaining dough is sheeted a final time before cutting. The final gap setting is adjusted for each sample to ensure the resulting noodle strands have a thickness of 1.4 mm. Noodle strands are cut using a No. 10 or No. 20 cutter to produce noodles with a width of 3.0 or 1.5 mm, respectively.

NOODLE TEXTURE — CIGI INTERNAL METHOD

Noodles (16 strands, 5 cm length) are assessed for texture by cooking in boiling water (500 mL) for three different cooking times (2.5, 3.5 and 5.0 min). After each cooking time, the noodles are drained, cooled in water (22°C, 1.5 min) and placed in a sieve. A TA.XTplus Texture Analyzer with a firmness blade (TA-47) is used to measure maximum cutting stress (g/mm^2). The average of two measurements taken on five strands are reported for each sample at each cooking time.

PARTICLE SIZE INDEX (PSI) — AACCI METHOD 55-30.01

Wheat kernel hardness is assessed by determining the particle size index using AACCI Method 55-30.01 with modifications. Wheat, with moisture content between 11.0-13.0%, is ground using an UDY Cyclone grinder (1.0 mm screen) and a feed rate regulator (52 rpm). Ground wheat is sieved using a Ro-tap sieve shaker.

PROTEIN CONTENT — WILLIAMS ET AL. 1998

Protein content (N x 5.7) is measured by a combustion nitrogen analysis (CNA) method using the LECO FP-528 according to Williams *et al*. (Protein testing methods. In, Wheat Protein, Production and Marketing. Proceedings of the Wheat Protein Symposium. Saskatoon, SK. University of Saskatchewan Press. March 9-10, 1998. pp. 37-47). Drift corrections are done using EDTA.

RVA – PASTING PROFILE — AACCI 76-21.01

Evaluation of the pasting profile of flour is performed using the RVA 4500 according to AACCI 76-21.01 (STD1, 13 min profile). The following parameters are measured: peak viscosity is the maximum viscosity during the heating cycle; peak time is the time at peak viscosity; pasting temperature is the temperature where a rapid increase in viscosity occurs; hot paste viscosity is the minimum viscosity observed during the heating period; breakdown is the difference between peak and hot paste viscosities; final viscosity is the viscosity at the end of the test; setback is the difference between final and hot paste viscosities.

SEMOLINA YIELD – LAB MILLING — CIGI INTERNAL METHOD

Durum wheat for milling is cleaned using a dockage tester with standard screens and then tempered overnight (16.5% moisture). Milling is done using a Bühler laboratory durum mill (MLU-202) using a preset feed rate and roll gap settings to obtain semolina and finer granulation material. After milling, the semolina is purified using a Namad laboratory purifier and combined with the finer granulation material to produce the final semolina yield.

SPAGHETTI – COOKED WEIGHT — CIGI INTERNAL METHOD

Dried spaghetti (30 g, 1 cm length) is cooked in boiling water (300 mL) to its cooking time (CT) which is defined as the time when the centre core of the spaghetti just disappears when pressed between two Plexiglas plates. After the CT is reached, the spaghetti is drained and weighed. Cooked weight is calculated as a percentage of the initial spaghetti weight.

SPAGHETTI – COOKING LOSS — CIGI INTERNAL METHOD

Dried spaghetti (30 g, 1 cm length) is cooked in boiling water (300 mL) to its cooking time (CT) which is defined as the time when the centre core of the spaghetti just disappears when pressed between two Plexiglas plates. After the CT is reached the spaghetti is drained and the cooking water is retained. The cooking water is evaporated (130°C, 24 h) and the remaining residue is weighed and expressed as a percentage of the initial spaghetti weight.

SPAGHETTI – FIRMNESS — CIGI INTERNAL METHOD

Dried spaghetti (12 strands, 5 cm length) is cooked in boiling water (250 mL, 9 min). After cooking, the spaghetti is drained and placed on a fine sieve. A TA.HD Texture Analyzer with a firmness blade (TA-47) is used to measure firmness. The average of four measurements are reported for each sample (two measurements per set of five strands).

SPAGHETTI – PROCESSING (LAB SCALE) — CIGI INTERNAL METHOD

A Namad laboratory extruder with a Teflon die (1.80 mm diameter) is used to process spaghetti. Spaghetti is dried using a Bühler batch dryer using a high temperature drying cycle (85°C).

SPECIFIC VOLUME - BREAD — AACCI METHOD 10-14.01

The BVM-L370 (TexVol) is used to measure loaf volume (cm^3) according to AACCI Method 10-14.01. Specific volume (cm^3/g) is calculated as the ratio of loaf volume to loaf weight.

STARCH DAMAGE — AACCI METHOD 76-33.01

Starch damage is measured using the SDmatic according to AACCI Method 76-33.01 and is reported in UCD.

STEAMED BREAD PROCESSING (LAB SCALE) — CIGI INTERNAL METHOD

Ingredients are mixed using a GRL-1000 mixer (45 rpm, 0.5 min) and then at a higher speed (105 rpm) until the dough is developed. The dough is rested (15 min) and then sheeted (20 passes, 5.5 mm gap). The dough sheet is subsequently rolled into a cylinder and six dough pieces are scaled (150 g each), and then rounded by hand. The dough pieces are placed in a covered steamer tray, and proofed (45 min, 32°C, 85% RH), and then steamed (25 min) in a commercial steamer.

STEAMED BREAD EVALUATION — CIGI INTERNAL METHOD

Steamed breads are weighed and measured for height and width. Volumes are determined by rapeseed displacement. The colour of the steamed bread skin is measured by a Minolta Chroma Meter CR-410 (C illuminant). The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = redness); b* (-b* = blue to +b* = yellow). Breads are scored by a trained sensory panel using an in-house developed scoring system. Steamed breads are evaluated for physical measurements of weight, width, height and volume and sensory measurements of exterior appearance, crumb structure and colour, texture and overall acceptability.

YELLOW PIGMENT CONTENT — FU ET AL. 2013

Semolina yellow pigment content is determined according to Fu *et al*. (2013. J. Cereal Sci. 57: 260-566).

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