Methods — Wheat

At the Grain Research Laboratory (GRL), unless otherwise specified,

- Analytical results for wheat are reported at 13.5% moisture content.
- Analytical results for flour and semolina are reported at 14.0% moisture content.
- AACC methods cited are from The American Association of Cereal Chemists (AACC): *Approved Methods of the American Association of Cereal Chemists*, Tenth Edition, 2000.
- ICC methods cited are those of the International Association for Cereal Science and Technology (ICC): *ICC Standards: Standard Methods of the International Association for Cereal Science and Technology*, 7th supplement, 1998
- Grade determinants and procedures are those used by Industry Services, Canadian Grain Commission (CGC).

AGTRON colour

The AGTRON colour of flour and durum wheat semolina is determined using AACC Method 14-30. An AGTRON direct reading reflectance spectrophotometer is used.

Alveogram

For all classes with the exception of CWAD, ICC Standard Method No. 121 is followed, using the constant pressure Chopin Alveograph Model MA82. Total mixing time is modified depending on wheat class as follows: CWES 8 min; CWRS 7.5 min; CWRW 7 min; CPSR, and CPSW 6.5 min; and CWSWS and CEWW 6 min. Chopin standard procedure using a Chopin Alveograph NG is followed for CWAD. Total mixing time is 8 min. Following milling, flour samples are stored for a minimum of seven days prior to analysis.

α-amylase activity

The α-amylase activity of wheat and flour is determined by the method of Kruger and Tipples (1981), *Cereal Chemistry* 58:271-274.

Amylograph peak viscosity

Sixty-five grams of flour and 450 mL of distilled water are used with the Brabender amylograph and the pin stirrer. Other details are as in AACC Method 22-10. Peak viscosity is reported in Brabender units.

Ash content

To determine wheat, flour or semolina ash content, AACC Method 08-01 is used. Samples are incinerated overnight in a muffle furnace at 600°C.

AWRC

Alkaline water retention capacity (AWRC) is determined using AACC Method 56-10. Centrifugation is done at 1000 x *g* using a swinging bucket rotor.

Canadian short process baking test

The Canadian short process baking test, as described by Preston et al. (1982), Canadian Institute of Food Science and Technology Journal 15:29-36, is followed, using 150 ppm ascorbic acid as the oxidant and reducing the salt to 2%. Dough is mixed in a Swanson type 100-200g pin mixer (National Manufacturing Co., Lincoln NE) at 116 rpm. Loaves are produced from 200 grams of flour in baking pans with cross-sectional dimensions similar to Canadian commercial baking pans. Loaf volume is reported on a 100-gram flour basis. Mixing energy is measured in watt-hours per kilogram (Wh/kg).

Cookie test

The cookie test is performed according to AACC Method 10-50D.

Dry gluten content • semolina

Semolina dry gluten content is determined using AACC Standard Method 38-12A, following the procedure for whole meal.

Extensogram

This test is conducted using AACC Method 54-10 with the exception that the dough is not stretched at 90 minutes and, for CWES, the total dough mixing time is fixed at 2 minutes. Length is in centimetres, height is in Brabender units (BU), and area is in square centimetres. The extensograph is set so that 100 Brabender units equal a 100-g load.

Falling number

The falling number is determined on a 7-g sample of ground wheat or semolina by AACC Method 56-81B. A 300-g sample of wheat is ground in a Falling Number Laboratory Mill 3100 according to ICC Standard Method No. 107.

Farinogram

This test is conducted using AACC Method 54-21, following the procedure for constant flour weight using the small bowl.

- Farinograph absorption is the amount of water that must be added to flour to give the required consistency. It is reported as a percentage.
- Dough development time (DDT) is the time required for the curve to reach its maximum height reported to nearest 0.25 min.
- Mixing tolerance index (MTI) is the difference, in Brabender units, between the top of the curve at the peak and the top of the curve measured 5 min after the peak is reached.
- Stability is defined as the difference in time, to the nearest 0.5 min, between the point at which the top of the curve first intersects the 500-BU line (arrival time) and the point at which the top of the curve leaves the 500-BU line (departure time).

For CWES, farinograph absorption is determined at 63 rpm. Remaining quality parameters are measured at 90 rpm based on absorption obtained at 63 rpm. For additional details, see the *Farinograph Handbook*, AACC, 1960.

Flour yield

Wheat is cleaned, scoured and tempered overnight to optimum moisture as described by Dexter and Tipples (1987), *Milling* 180(7):16, 18-20. All millings at the GRL are performed in rooms with environmental control maintained at 21°C and at 60% relative humidity.

- Common wheat is milled on an Allis-Chalmers laboratory mill using the GRL sifter flow as described by Black et al. (1980), *Cereal Foods World* 25:757-760. Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis. For CWRS wheat, flour yield also is expressed at a constant ash content of 0.50%, as described by Dexter and Tipples (1989), *Milling* 182(8):9-11.
- No. 1 CWRS -13.5 composites are milled to straight grade and patent flours using a tandem Bühler laboratory mill as described by Martin and Dexter (1991), *Association of Operative Millers* - Bulletin April:5855-5864 to allow direct comparison of the milling and baking properties of the current and previous year's crop. Sixty percent extraction patent flours are used for noodle evaluation.

Gluten index • semolina

Durum semolina gluten index is determined using AACC Standard Method 38-12A, following the procedure for whole meal.

Grade colour

Flour grade colour is determined using a Colour Grader Series IV (Satake UK, Stockport, UK) according to Flour Testing Panel Method No. 007/4 (Flour Milling and Baking Research Association 1991), and expressed in Satake International colour grade units. The lower the number, the brighter the colour.

Hard vitreous kernels

The percentage of hard vitreous kernels (HVK) is determined by examination of a sieved 25-g sample for the natural translucency associated with hardness. Kernels are classed as HVK or non-vitreous as defined in the Canadian Grain Commission's *Official Grain Grading Guide*, Chapter 4, Wheat.

Maltose value

Maltose value is determined according to AACC Method 22-15.

Moisture content • flour

To determine the moisture content of flour, a 10-g sample is heated for 1 hr in a semi-automatic Brabender oven at 130°C.

Moisture content • wheat

The moisture content of wheat is determined using the Model 919 moisture meter calibrated against the AACC method 44-15A, following the procedure for two-stage air-oven.

Noodle colour

Colour is determined on a raw noodle sheet using a Hunterlab Labscan II spectrocolorimeter using the CIE (1976) L*, a* and b* colour scale with a D65 illuminant.

- L* is a measure of brightness.
- a* indicates red-green chromacity. Positive values indicate increased redness.
- b* indicates yellow-blue chromacity. Positive values indicate increased yellowness.

Noodle preparation

Noodles are prepared following the method of Kruger et al (1994), *Cereal Chemistry* 71:177- 182. Yellow alkaline noodles are prepared with a 1% *kansui* reagent (9:1 sodium and potassium carbonates) at a 32% water absorption. White salted noodles are prepared using a 1% sodium chloride solution at a 30% water absorption level to maintain proper dough crumb and sheeting characteristics.

Protein content (N x 5.7)

Protein content (N x 5.7) of the composite samples is determined by combustion nitrogen analysis (CNA). Samples are ground on a UDY cyclone sample mill fitted with a 1.0-mm screen. Sample size is 250-mg and samples are not dried before analysis. Protein content is calculated from total nitrogen as determined on a LECO Model FP-528 CNA analyzer calibrated with EDTA and reported on a constant moisture basis. Moisture content is determined by the AACC Method No. 44-15A, following the procedure for one-stage air-oven. The method for Dumas CNA analysis is explained in Williams, Sobering, and Antoniszyn. 1998. Protein testing methods at the Canadian Grain Commission. In: Wheat Protein Symposium: proceedings; 1998 March 9-10; Saskatoon, Sask. P 37. The conference paper is available online at: http://grainscanada.gc.ca/Pubs/confpaper/Williams/ProteinOct98/protein1-e.htm

PSI

Particle size index (PSI) is a measure of the texture of a wheat kernel. AACC Method No. 55-30 is modified by using a UDY cyclone sample mill fitted with a feed rate regulator and a 1.0-mm screen. A 10-g sample from 22 g of ground, blended wheat is sieved over a US Standard 200-mesh sieve for 10 min in a Ro-tap sieve shaker. The weight of throughs X 10 is recorded as the PSI.

Remix-to-peak baking test

The remix-to-peak baking test is a modification of the remix baking test of Irvine and McMullan (1960), *Cereal Chemistry* 37:603-613, as described in detail by Kilborn and Tipples (1981), *Cereal Foods World* 26:624-628. Dough is mixed to peak consistency at the second mixing stage.

SDS sedimentation

SDS sedimentation volumes are determined by a modified version of Axford and Redman (1979), *Cereal Chemistry* 56:582-584, using 3% SDS as described by Dexter et al. (1980) *Can. J. Plant Sci.* 60:25-29.

Semolina colour

Durum semolina colour is determined using a Minolta Model CM-525i spectrophotometer and expressed as L*, which indicates lightness, a* which represents redness, and b* which represents yellowness. L*a*b* is referred to as the CIELAB colour space. Differences in particle size have a significant effect on colour readings. Semolina samples with similar particle size distributions are used for comparability.

Semolina yield

Durum wheat is milled on a four stand Allis-Chalmers laboratory mill in conjunction with a laboratory purifier as described by Black (1966), *Cereal Science Today* 11:533-534, 542. The mill flow is described by Dexter et al. (1990), *Cereal Chemistry* 67:405-412. Semolina is defined as having less than 1% pass through a 149-micrometre sieve. Milling yield, the combination of semolina and flour, and semolina yield are reported as a percentage of the cleaned wheat on a constant moisture basis.

Spaghetti

Spaghetti is processed from semolina using the micro-processing method of Matsuo et al (1972), *Cereal Chemistry* 49:707-711, and dried at 70°C in a computer controlled laboratory-scale dryer (AFREM, Lyon, France).

Spaghetti colour

Spaghetti colour is determined using a Minolta Model CM-525i spectrophotometer and expressed as L* which indicates lightness, a* which represents redness, and b* which represents yellowness. L*a*b* is referred to as the CIELAB colour space. For colour measurement, a 5-cm band of spaghetti strands is mounted on white cardboard using double-sided tape.

Spaghetti cooking quality

Spaghetti cooking quality as measured by cooking quality parameter (CQP), is determined as described by Dexter and Matsuo (1977), *Canadian Journal of Plant Science* 57:717-727. Spaghetti firmness is determined using the Stable MicroSystems TA.XT2i Texture Analyser following AACC Method 66-50, with a crosswise cut through 10 strands of spaghetti cooked to optimum.

Speck count

Speck count is determined as described by Dexter and Matsuo (1982), *Cereal Chemistry* 59:63-69.

Sponge-and-dough baking test

The sponge-and-dough baking test is based on a 4.5-hour fermentation, 70% sponge system as described by Kilborn and Preston (1981), Cereal Chemistry 58:198-201. Ascorbic acid is used as the oxidant at 40 ppm. Dough is mixed in a Swanson type 100-200g pin mixer (National Manufacturing Co., Lincoln NE) at 116 rpm. Loaves are produced from 200 grams of flour in baking pans with cross-sectional dimensions similar to those of Canadian commercial baking pans. Loaf volume is reported on a 100-gram flour basis. Mixing energy is measured in watt-hours per kilogram (Wh/kg).

Starch damage

Starch damage is determined using AACC Method 76-31 *Damaged Starch: Spectrophotometric Method*. Starch damage is expressed as a percentage of flour weight. The method is also referred to as the Megazyme method.

Test weight • export cargo

Test weight is determined using the Ohaus 0.5-L measure, a Cox funnel to standardize the pouring rate, and a striker to level the contents of the container. The grain in the container is poured into the pan of an approved electronic scale for weighing. The scale connects to a computer which calculates the test weight of the grain in kilograms per hectolitre (kg/hL) from grams weighed by the scale. If the computer interface is not available, test weight conversion charts are used.

Test weight • harvest survey

Test weight is determined using the Schopper chondrometer equipped with a 1-L container. The weight in grams of the measured litre of wheat is divided by 10. The result is reported in kilograms per hectolitre (kg/hL) without reference to the moisture content.

Texture characteristics

Texture measurements were carried out using a computer-assisted Stable Micro Systems TA-XT2i Texture Analyser and represent the average of four replicate cookings in which each cook evaluated five sets of noodles. Characteristics were determined as per Oh, N.H. et al. (1983), *Cereal Chemistry* 60:433-438.

- Maximum cutting stress (MCS, g/mm^2) reports the bite or firmness of the cooked noodle (g/mm^2)
- Resistance to compression (RTC, %) correlates with the noodle's firmness and chewiness.
- Recovery, % correlates with the noodle's firmness and springiness.

Weight per 1000 kernels

Broken kernels and foreign material are handpicked from a sample to create a cleaned sample. The number of kernels in a 20-g subsample of the cleaned sample is then counted using an electronic seed counter.

Wet gluten content • flour

ICC Standard Method No. 137/1 is followed using the Glutomatic System 2200 with 80 micrometre metal sieves.

Wet gluten content • semolina

Semolina wet gluten content is determined using AACC Standard Method 38-12A, following the procedure for whole meal. The method gives lower values compared to the ICC Standard Method No. 137/1 used prior to August 1, 1998.

Yellow pigment content

Yellow pigment content of durum wheat and semolina is determined using AACC Method 14-50.