Method for Lean No Time Test Baking

<table>
<thead>
<tr>
<th>Method Owner(s)</th>
<th>Approval date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Manager of Bread and Durum Wheat Research</td>
<td>2016-08-29</td>
</tr>
</tbody>
</table>
Table of Contents

1.0 Scope and Field of Application ......................................................................................................................3
2.0 Principle..........................................................................................................................................................3
3.0 References ......................................................................................................................................................3
4.0 Materials .........................................................................................................................................................3
4.1 Lab ware .....................................................................................................................................................3
4.2 Equipment and Apparatus ..........................................................................................................................3
5.0 Formula and Ingredients .................................................................................................................................5
5.1 Formulation (%flour weight basis).............................................................................................................5
5.2 Ingredients ..................................................................................................................................................5
6.0 Solutions .........................................................................................................................................................5
6.1 Yeast suspension (2.5% of flour weight)....................................................................................................5
6.2 Salt (4% w/v) and sugar (16% w/v) solution (1 and 4% of flour weight, respectively) .........................6
6.3 Ammonium phosphate solution (10% w/v or 0.1% of flour weight) .........................................................6
7.0 Procedure ........................................................................................................................................................6
7.1 Equipment and Lab Ware Set-up ................................................................................................................6
7.2 Sample Mixture Preparation .......................................................................................................................7
7.3 Mixing ........................................................................................................................................................7
7.4 Punching .....................................................................................................................................................8
7.5 Sheeting and Moulding ...............................................................................................................................8
7.6 Panning .......................................................................................................................................................8
7.7 Proofing ......................................................................................................................................................9
7.8 Baking ......................................................................................................................................................10
7.9 Loaf Evaluation ........................................................................................................................................10
8.0 APPENDIX 1: Factors to consider in calculating bake absorption ..........................................................11
1.0 Scope and Field of Application

This method was developed to assess the impact of inherent dough strength on bread making quality of Canadian wheat flours. The greater discriminating power of this test bake method led to its unanimous support and adoption in 2015 as the method of choice to assess breeder lines in future Canadian wheat variety registration trials, replacing both the Canadian short process (CSP) and the remix-to-peak test bake methods. In addition, a new parameter, loaf top ratio, was introduced to provide objective assessment of dough handling properties.

2.0 Principle

The lean no time (LNT) baking test, as described by Dupuis and Fu (2016), minimizes the use of ingredients that in their improving effect can mask inherent dough strength. Dough is mixed in a Swanson type 100-200 gram pin mixer (National Manufacturing Co., Lincoln NE) at 116 rpm. Loaves are produced from 150 grams of flour. Loaf volume is reported on a 100-gram flour basis. Mixing energy is reported in watt-hours per kilogram (W-h/kg) of dough.

3.0 References


4.0 Materials

This list details materials used by the Bread Wheat Research unit of the Grain Research Laboratory. Small modifications, depending on laboratory resources, can be acceptable.

4.1 Lab ware

4.1.1 Laboratory glassware of various types and sizes including beakers, graduated cylinders, reagent bottles and volumetric flasks
4.1.2 Bottle top dispensers – Dispensette with variable volume: 0.5-5 mL, 1-10 mL and 5-50 mL
4.1.3 Metal tins with lids, 250 grams
4.1.4 Magnetic stir bars
4.1.5 Timers
4.1.6 Thermometer/Hygrometer

4.2 Equipment and Apparatus
4.2.1 Circulating water bath
4.2.2 100-200g pin mixer (National Mfg. Co.)
4.2.3 Warming/resting cabinet (GRL)
4.2.4 Sheeter (National Mfg. Co.)
4.2.5 Moulder (GRL or National Mfg. Co.)
4.2.6 Fermentation cabinet (National Mfg. Co.)
4.2.7 Electric reel oven (National Mfg. Co.)
4.2.8 Baking crocks with lids
4.2.9 Proof height gauge (Mitutoyo Absolute Digimatic Height Gauge)
4.2.10 Cooling racks
4.2.11 Volscan Profiler 300 (Stable Micro Systems, Surrey, UK)
4.2.12 Electronic balances
4.2.13 Stir plate
4.2.14 Pup loaf (100g) baking pans (National Mfg. Co.). Approximate pan dimensions currently being used:

**National Manufacturing pan dimensions**

(Volume: approximately 550 ml)

<table>
<thead>
<tr>
<th>in cm</th>
<th>Length</th>
<th>Width</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Inside</td>
<td>14.2</td>
<td>7.9</td>
<td>5.7</td>
</tr>
<tr>
<td>Bottom Outside</td>
<td>12.8</td>
<td>6.4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>in inches</th>
<th>Length</th>
<th>Width</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Inside</td>
<td>5 5/8</td>
<td>3 1/8</td>
<td>2 1/4</td>
</tr>
<tr>
<td>Bottom Outside</td>
<td>5</td>
<td>2 1/2</td>
<td></td>
</tr>
</tbody>
</table>
5.0 Formula and Ingredients

5.1 Formulation (%flour weight basis)

- Yeast: 2.5%, varies with activity
- Salt: 1.0%
- Sugar: 4.0%
- Shortening: 1.0%
- Ammonium phosphate: 0.1%
- Flour: 100%

5.2 Ingredients

- 5.2.1 Yeast, fresh compressed, commercial
- 5.2.2 Salt, non-iodized fine sodium chloride, commercial grade
- 5.2.3 Sucrose, fine granulated, commercial grade
- 5.2.4 Ammonium phosphate, monobasic, reagent grade
- 5.2.5 Shortening (must be at room temperature), Crisco
- 5.2.6 Flour
- 5.2.7 Distilled water, reverse osmosis

6.0 Solutions

6.1 Yeast suspension (2.5% of flour weight)

*Note: Prepare fresh solution daily.*

- 6.1.1 Weigh 100 g of freshly crumbled yeast into a 500 mL beaker and add about 300 mL distilled water.
- 6.1.2 Stir to make a suspension.
- 6.1.3 Transfer to a 500 mL volumetric flask and bring to volume.
- 6.1.4 Transfer the solution with a magnetic stirrer to a 1 L dispensing bottle fitted with a 50-mL variable pump dispenser set and calibrated to dispense 18.75 mL.
- 6.1.5 Keep stirring the solution with a stir plate until the required volume for each sample has been dispensed.
6.2 Salt (4% w/v) and sugar (16% w/v) solution (1 and 4% of flour weight, respectively)

6.2.1 Weigh 160 g sugar and 40 g salt into a 1 L volumetric flask. Add about 500 mL distilled water.
6.2.2 Stir until dissolved.
6.2.3 Bring the solution to 1 L with distilled water.
6.2.4 Store for up to one week in a 1 L dispensing bottle fitted with a 50-mL variable pump dispenser set and calibrated to dispense 37.5 mL.

6.3 Ammonium phosphate solution (10% w/v or 0.1% of flour weight)

6.3.1 Weigh 25 g ammonium phosphate into a beaker and add about 150 mL distilled water.
6.3.2 Stir until dissolved.
6.3.3 Bring to 250 mL with distilled water in a volumetric flask.
6.3.4 Store for up to 1 month in a 250-mL dispensing bottle fitted with a 5-mL variable pump dispenser set and calibrated to dispense 1.5 mL.

7.0 Procedure

7.1 Equipment and Lab Ware Set-up

Note: Set up equipment 45-60 mins before starting. Throughout the procedure, verify that all equipment is running properly.

7.1.1 Turn on the circulating water bath, set at 25°C, to circulate through the mixing bowl jacket.
7.1.2 Remove the mixing bowl from the pin mixer.
7.1.3 Turn the mixer on and allow the mixer to run (116 rpm) to warm up and equilibrate before calibration and set up of the P2M software.
7.1.4 Turn on the warming (resting) cabinet, set to 30°C (no humidity control).
7.1.5 Turn on the proofer with settings at 38°C, 85% RH, fill the water reservoir (located on top) if the level is below half.
7.1.6 Place in the oven one 1L metal container filled with water.
7.1.7 Turn on the oven and set to 400°F (205°C)
7.1.8 Verify if there is a need to calibrate the moulder weight and if the moulder belt requires tightening (this step can be ignored if not using a GRL moulder).
7.1.9 Grease baking pans and place inside the warming cabinet.
7.2 Sample Mixture Preparation

Note: Include at least one blank sample and two control flour samples for every bake. Since the lean no time bake method determines the proofing time for the samples to be tested based on the time it takes the control flour sample to reach a proof height of 110 mm, the first control flour sample should be the first sample after the blank. The second control should be randomly sequenced in the day’s bakes.

7.2.1 Prepare one bake record per sample. Record sample number (sample ID), bake date, bake method, moisture content (if this value is old, a new moisture content should be taken), and farinograph absorption (14% mb).
7.2.2 Use a baking schedule to track the processing time for each sample.
7.2.3 Weigh 150 g flour (corrected to 14 % moisture basis) into a 250-mL metal tin with lid (pre-weigh all flour samples in advance before starting the first mix and place into numbered tins, each number corresponding to the sample number).
7.2.4 Weigh 1.5 g shortening (must be at room temperature) and add into each metal tin containing the pre-weighed flour sample (can be done the day before).
7.2.5 Cover the metal tin(s) until ready to mix.

7.3 Mixing

7.3.1 In a 250 mL beaker, weigh the amount of distilled water required for bake absorption (see Appendix 1 for factors to consider).
7.3.2 To the water, dispense 37.5 mL salt-sugar solution (6.2) and 1.5 mL ammonium phosphate solution (6.3). Set the beaker aside.
7.3.3 Place the flour and shortening (7.2.5) into the 200-g National mixer bowl.
7.3.4 Create a depression in the center by pushing some of the mixture to the sides of the bowl.
7.3.5 Dispense 18.75 mL yeast suspension (6.1) into the beaker containing solutions (7.3.2).
7.3.6 Pour the combined solutions into the depressed center of the dry ingredients in the mixer bowl.
7.3.7 Stop the mixer warm up.
7.3.8 Secure the bowl onto the mixer.
7.3.9 Start the mixer and P2M software.
7.3.10 Mix the dough to 10% past peak (the P2M software will indicate this by moving the red line to peak).
7.3.11 Once the optimum peak is reached, immediately stop the mixer and P2M software.
7.3.12 Grease the baking crock (numbered according to the sample number), balance pan and your hands.
7.3.13 Remove the dough from the mixer bowl and mixer pins and place on the greased balance pan. Record dough weight and dough temperature on the baking schedule.
7.3.14 Record dough weight in the P2M software.
7.3.15 Round the dough by hand seven times, and then transfer the dough into the appropriately numbered and greased baking crock and cover.
7.3.16 Put the covered baking crock with the dough in the warming cabinet and let the dough rest for 15 minutes.

At this point, the next sample can be mixed following the baking schedule.

7.4 Punching

7.4.1 Remove the crock from the warming cabinet.
7.4.2 Dust the counter top with flour.
7.4.3 Remove the dough from the crock and dust its surface by rolling it onto the flour-dusted countertop. Tap any excess flour off the dough.
7.4.4 With the underside (rough side) of the dough facing toward you, sheet the dough one pass through gap #2 (set at 7/32 inch). As the dough passes through the gap, catch it as it exits from underneath.
7.4.5 Sheet the dough one pass through gap #3 (set at 5/32 inch). As the dough passes through gap #3, catch it as it exits from underneath.
7.4.6 Fold the dough in half, then in half again, place the dough back into the crock and return the crock to the resting cabinet for 15 minutes.

7.5 Sheeting and Moulding

7.5.1 Remove the crock from the warming cabinet.
7.5.2 Dust the counter top with flour.
7.5.3 Remove the dough from the crock and dust its surface by rolling it onto the flour-dusted countertop. Tap any excess flour off the dough.
7.5.4 With the underside (rough side) of the dough facing toward you, sheet the dough one pass through gap #1 (set at 5/16 inch). As the dough passes through the gap, catch it as it exits from underneath.
7.5.5 Place the dough on the moulder belt and adjust the sheeter gap to #2 (set at 7/32 inch).
7.5.6 Sheet the dough one pass through gap #2. As the dough passes through gap #2, catch it as it exits from underneath.
7.5.7 Place the dough on the moulder belt and adjust sheeter gap to #3 (set at 1/8 inch).
7.5.8 Sheet the dough one pass through gap #3. As the dough passes through gap #3, catch it as it exits from underneath.
7.5.9 Place the bottom of the dough sheet so it is lying on the moulder belt closest to the roller. Gently stretch this end to make it “square” (leading edge parallel to the moulding rolls) then manually create a roll by rolling the dough edge up and towards you 3 times.
7.5.10 Lift the dough and place the rolled end into the rollers.
7.5.11 Drop the top roll onto the dough piece.
7.5.12 Start the moulder and guide the dough sheet into the rolls. The dough will mould for 30 seconds (automatic timer).

7.6 Panning
7.6.1 In a pre-warmed greased baking pan, place an appropriate numbered, full-length label face down in the bottom of the pan.
7.6.2 Remove the dough roll from the moulder and place it on the countertop.
7.6.3 Manually evaluate the stickiness by touching each end with your index fingers.

(i) If the dough sticks to your fingers but recovers to original form, the bake absorption is considered acceptable.
(ii) If the dough is sticky and does not recover to original form, make a note to decrease the water absorption for the next bake replicate.
(iii) If the dough does not stick to your fingers, it is considered too dry. Make a note to increase water absorption for the next bake replicate.

7.6.4 Place the dough roll into the greased baking pan so that it is pushed to one side and the seam is straight and facing down (by doing this, the break and shred of the bread will be on one side only, making it easier to evaluate).
7.6.5 With flour dusted fingers, tuck the ends of the loaf under.

7.7 Proofing

7.7.1 Place the pan with dough into the proofer and verify that thermometers and hygrometers are at 38°C and 85 % RH, respectively.
7.7.2 Record the temperature and RH at regular intervals throughout the bake schedule.
7.7.3 After about 60 minutes, remove the pan containing the control flour dough from the proofer.
7.7.4 Measure the height of the “control” dough:

(i) If the height after 60 minutes proofing is at 110 mm, the yeast is considered very active and proof time for all samples that day must be decreased. Then for subsequent bakes with that same yeast, decrease the amount of dry yeast by about 0.3 g and proof for 65 minutes.
(ii) If the height after 60 minutes proofing has not reached 110 mm, return the check dough back to the proofer for an additional 5 minutes (total of 65 minutes).
(iii) If the height after 65 minutes proofing is still below 110 mm, the yeast is considered less active and proof time for all samples that day must be increased. Then for subsequent bakes with that same yeast, increase the amount of yeast by 0.3 g and proof for 65 minutes.

7.7.5 Note: The “control” dough is allowed to proof to a height of 110 mm after approximately 65 minutes. The proof time is recorded and used to make adjustments for all subsequent samples. These conditions will vary with yeast source and activity and should be optimized by individual laboratories.
7.8 Baking

7.8.1 After approximately 65 minutes proofing (or equivalent time to reach a proof height of 110 mm), place the pan in the rotary oven.
7.8.2 Bake for 30 minutes at 205°C (400°F).
7.8.3 Remove the pan from the oven; remove the loaf from the pan.
7.8.4 Immediately weigh the loaf, then place it on the baking rack to cool.

7.9 Loaf Evaluation

7.9.1 After one hour, measure the loaf volume using the Volscan Profiler 300 or other volume measurement device.
7.9.2 Record the loaf top ratio (LTR) using the maximum height (mm) and maximum width (mm) measurements from the Volscan Profiler 300. Calculation: LTR = (maximum height – 55) / maximum width. The number 55 is the inside depth in mm of the National Mfg. Co. 100 g pans. If using a different pan, with a different inside pan depth value, adjust this calculation accordingly. LTR can also be measured using a height gauge.
7.9.3 Optional: Digital crumb images may be taken (e.g. C-Cell measurements) and when required, loaf and crumb photographs may be taken.
8.0 APPENDIX 1: Factors to consider in calculating bake absorption

8.1 Bake absorption = Farinograph absorption + X%; adjustments are made based on subjective assessment by the baker of the dough just before panning.
8.2 Adjust (+/-) for difference in water resulting from flour weight correction to 14% moisture basis
8.3 Adjust for displacement of water in fresh yeast solution – calculate this displacement in-house or use the information provided in AACC International Method 10.10-03
8.4 Adjust for displacement of water in sugar-salt solution – calculate this displacement in-house.