

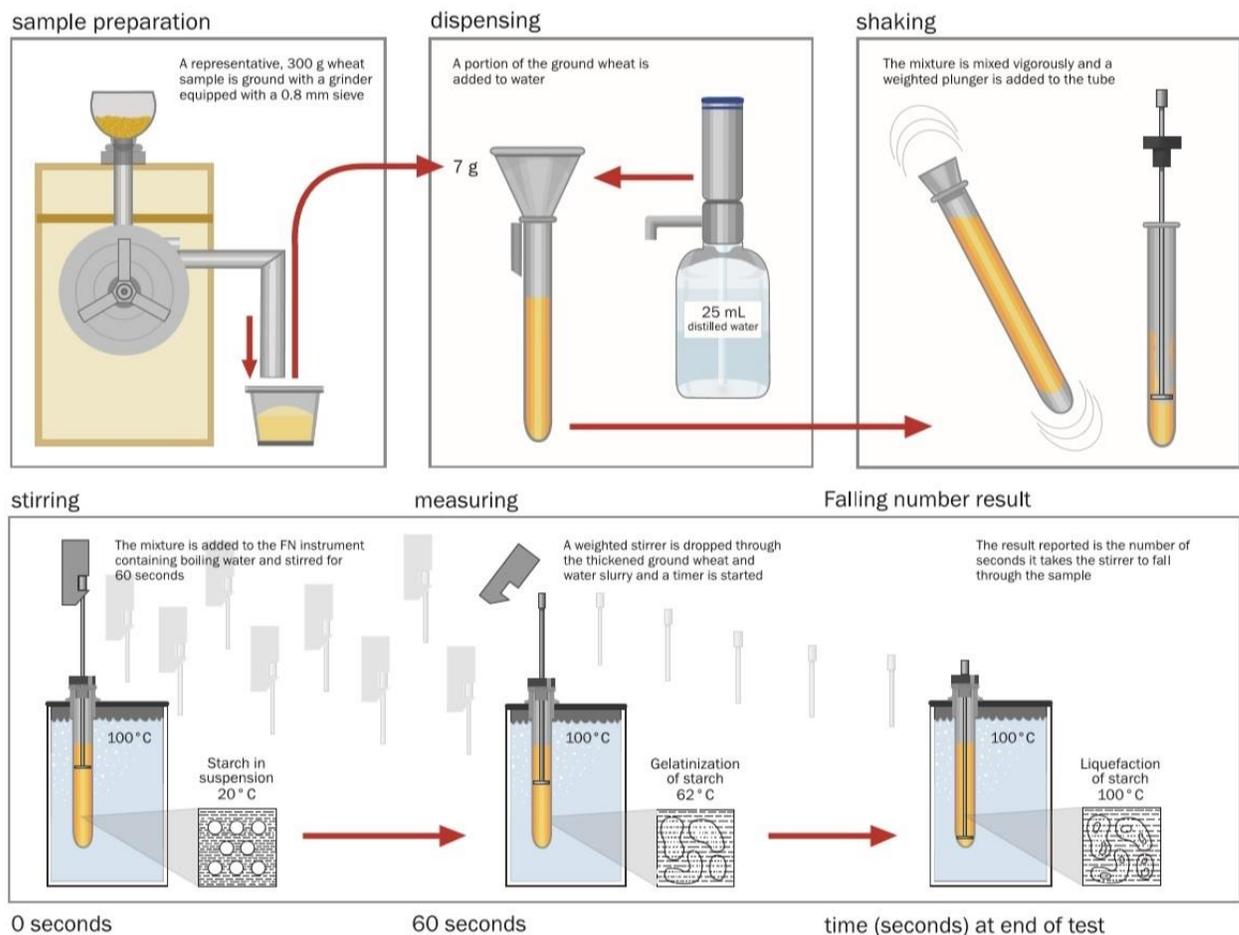
Falling Number Fact Sheet

What is falling number (typically referred to as FN)?

- A test that indirectly measures alpha-amylase activity, an indication of sprout damage. It can be done on wheat (when ground) or flour.
- Alpha-amylase is an enzyme which breaks down the starch that is present in grain into sugars.
 - Higher sprout damage = more alpha-amylase = more starch breakdown = lower FN.
 - Less sprout damage = less alpha-amylase = less starch breakdown = higher FN.
- A low FN can negatively impact the quality of various end-products made from wheat.
- Sprout damage, and FN, is influenced by environmental factors during harvest, such as excessive moisture (rain or heavy dew).

How the FN test is performed:

- The image below details the steps performed to complete a FN test.
 - <https://cigi.ca/wp-content/uploads/2020/04/falling-number-poster-2020-04.pdf>



- If alpha-amylase activity is low (less sprout damage), there is less breakdown of the starch into sugars and therefore the ground wheat and water slurry will be thick (viscous) and the stirrer will fall slowly through the mixture and the FN will be high.
- If alpha-amylase activity is high (more sprout damage), there is more breakdown of the starch into sugars and therefore the ground wheat and water slurry will be thin (not viscous) and the stirrer will fall faster through the mixture and the FN will be low.

Some factors that can influence the FN test:

- **Altitude:** A mathematical correction¹ should be done if a lab has an altitude higher than 760 m, (when testing flour) or 610 m (when testing wheat)².
- **Water:**
 - Temperature: Should be at room temperature (22 ± 2°C).
 - Water Quality: Distilled water should be used.
- **Variability of the test:**
 - FN tests on the same sample in the same lab could vary by ≤3.44% (repeatability)³.
 - FN tests done on the same sample in different labs could vary by ≤5.05% (reproducibility)³.

Two FN results from analysis of the same sample			Test is done in the same lab <i>Is the repeatability within acceptable limits?</i>	Test is done in different labs <i>Is the reproducibility within acceptable limits?</i>
<i>Rep 1</i>	<i>Rep 2</i>	<i>Avg</i>		
300 s	314 s	307 s	Yes, acceptable (≤ 3.44%)	Yes, acceptable (≤ 5.05%)
300 s	315 s	308 s	No, outside of acceptable limits (≥ 3.44%)	Yes, acceptable (≤ 5.05%)
300 s	322 s	311 s	No, outside of acceptable limits (≥ 3.44%)	Yes, acceptable (≤ 5.05%)
300 s	323 s	312 s	No, outside of acceptable limits (≥ 3.44%)	No, outside of acceptable limits (≥ 5.05%)

Why is the FN of a wheat sample important?

- FN affects quality:
 - For common (milling) wheats (CWRS, CPSR, CWRW, CNHR):
 - Bread can have reduced loaf volume (smaller in size), poor crumb structure (internal appearance of the slice of the bread) and overall poor colour. The image below shows some of these defects.

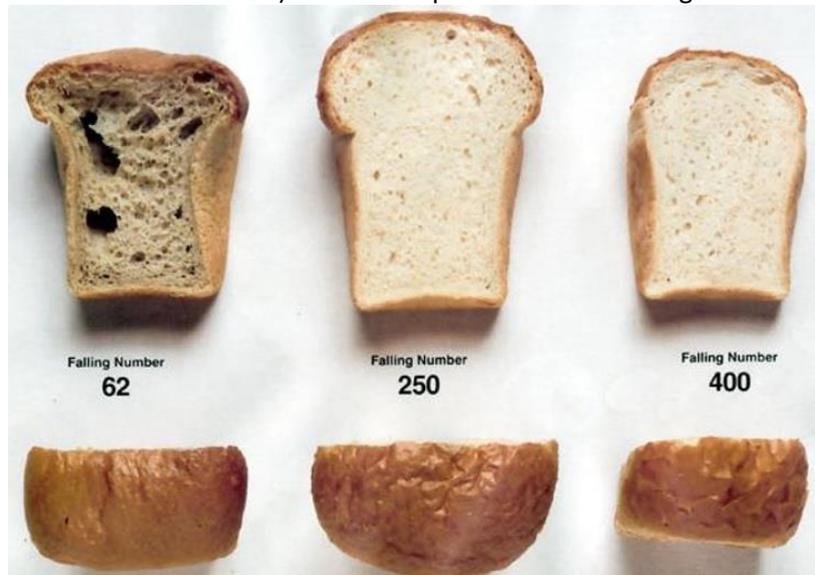


Image courtesy of Perten

- Flour can have poor water holding capacity resulting in challenges during processing (stickiness).

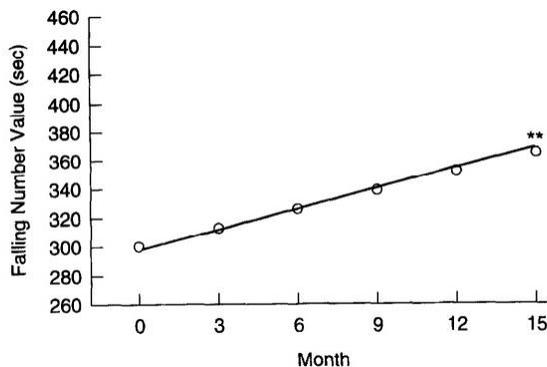
- Asian noodles can have higher cooking loss, poorer texture and colour, which are all quality defects.
- For durum wheat (CWAD):
 - Research conducted by Fu et al. (2014) examined the effect of sprout damage in CWAD and its impact on spaghetti quality.
 - If FN < 75 seconds: Spaghetti will have higher cooking loss, poorer texture (decreased firmness), and loss of strand strength (referred to as ‘checking’)⁴.
 - If FN < 150 seconds: Spaghetti can appear to have poorer colour (redder and less yellow)⁴.

How can wheat with low FN values be managed?

- Blending wheats with different FN values to achieve a desired FN can be challenging. Enzyme (alpha amylase) activity is not linear and therefore simple proportional blending does not work.
- To blend wheats to get a desired FN, try using a Perten calculator by entering the FN of the two wheats that you want to blend together and select the desired FN of the resulting blend ([Blending calculator from Perten](#)). The proportions of each wheat that are required will be calculated.
- Get your newly harvested wheat samples tested. The CGC Harvest Sample Program provides an unofficial grade as well as a FN result ([CGC Harvest Sample Program Sign-up](#)).

What else can affect FN results?

- *Grain storage*: ensure your grain is properly stored. Safe storage guidelines are documented on the CGC website ([CGC Grain Storage](#)). FN values may increase over time.
 - Research completed by Lukow et al. (1995) shown in the figure below suggests that FN values can increase over time⁵.



- Research by Steber (2017) wheat with a FN lower than 150 s will not benefit from long term storage. No significant increase in FN will likely be observed⁶.
- *Ensuring samples are representative*: ensure that the sample you have tested for FN is representative of the larger sample it is being taken from. Guidelines on taking a representative sample are on the CGC website ([Taking a representative sample](#)).
 - Differences in field elevation may influence FN results. Wheat plants grown at lower elevations may have lower FN values due to wetter soil conditions for longer periods compared to plants grown at higher elevations. To mitigate the variability in FN, ensure samples of grain are taken from multiple growing areas⁶.
 - One highly sprouted kernel in 2500 sound kernels can decrease the FN result by 100 seconds⁵.

- Researchers at North Dakota State University found that two visibly sprouted durum wheat kernels in 200 g of sound wheat can decrease the FN by 100 seconds⁷.

References: articles cited in this fact sheet are listed below

1. Delwiche, S. (2019). A New Correction Function for Falling Number at Non-Sea Level Conditions. *Cereal Foods World*, 64(2).
2. AACC Approved Methods of Analysis, 11th Ed. Method 56-81.04. Determination of Falling Number. Approved Nov 2, 1972. Cereals & Grains Association, St. Paul, MN, U.S.A.
<http://dx.doi.org/10.1094/AACCIIntMethod-56-81.04>
3. ICC Standard No. 107/1. (1995). Determination of the " Falling Number" According to Hagberg-As a Measure of the Degree of Alpha Amylase Activity in Grain and Flour Alpha-Amylase Activity (Falling Number).
4. Fu, B. X. Hatcher, D.W., & Schlichting, L. (2014). Effects of sprout damage on durum milling and pasta processing quality. *Canadian Journal of Plant Science*, 94, 545-553.
5. Lukow, O. M., White, N. D. G., & Sinha, R. N. (1995). Influence of ambient storage conditions on the breadmaking quality of two hard red spring wheats. *Journal of Stored Products Research*, 31(4), 279-289.
6. Steber, C. M. (2017). Avoiding problems in wheat with low Falling Numbers. *Crops and Soils*, 50(2), 22-25.
7. Sorenson, B. (2005). Sprout Damage in Cereal Grains and the Falling Number Assay. Website.
<http://www.ag.ndsu.nodak.edu/aginfo/smgrains/fallnum.htm> (accessed January 17, 2005).

