

# Falling Number:

A critical value for commercial bakeries



# Falling number

- Measure of enzymatic activity in flour
  - Alpha-amylase
- AACC method 56-81B
- Performed on a Perten Falling Number (FN) instrument
  - Heats, stirs, and times
- Values reported in seconds
  - Typically 250-280



# The test

- Approximately 7 grams of flour placed into test tube
- About 25 mL of water (varies based on moisture of the flour—should be standardized)
- Shake in a uniform manner to make a slurry/batter
- Insert the plunger and place into the machine
- Start the test and record results

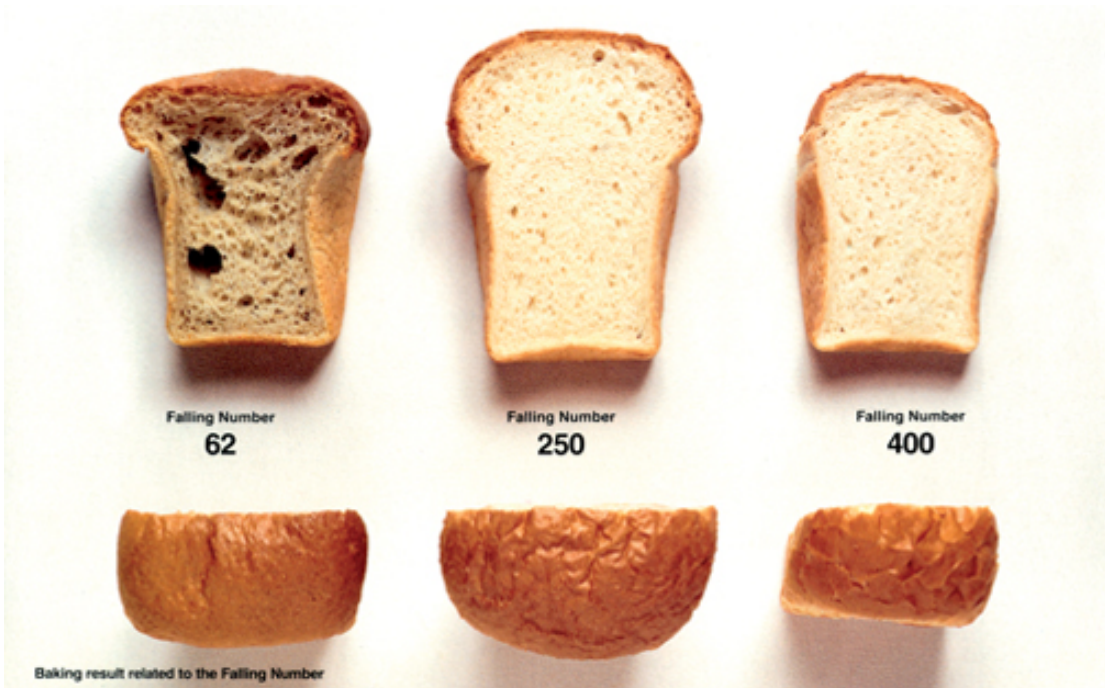


# What causes low-values?

- Low FN come from even small numbers of kernels that have sprouted or germinated in the field, in the truck, or in the bins
- Control during harvest (timing), transportation (temperature, time), and storage (temperature, moisture, time) are three opportunities when conditions can be right for kernels initiating growth
  - These conditions are generally warm and moist, but can also include precipitation during or following a cold spell
  - Kernels undergo a change where enzymes are released into the endosperm to break down starch into simple sugars to support growth
  - If milled, enzymes can continue to damage starch throughout shelf-life until deactivated
  - This process can be slowed with low storage temperatures and well-controlled moisture levels but not completely stopped

# What do the values mean?

- Numbers that are too low indicated a high amount of alpha-amylase from sprouted wheat
  - Low-loaf volume, excessive cookie spread, poor cake height/texture
  - Off-color, flavors
- Numbers that are too high indicate a high amount of damaged starch or high protein
  - Low loaf-volume, low-spread, tough texture



<https://www.calibrecontrol.com/news-blog/2019/7/18/why-using-the-world-standard-falling-number-method-is-important>  
(7 Feb 2022)

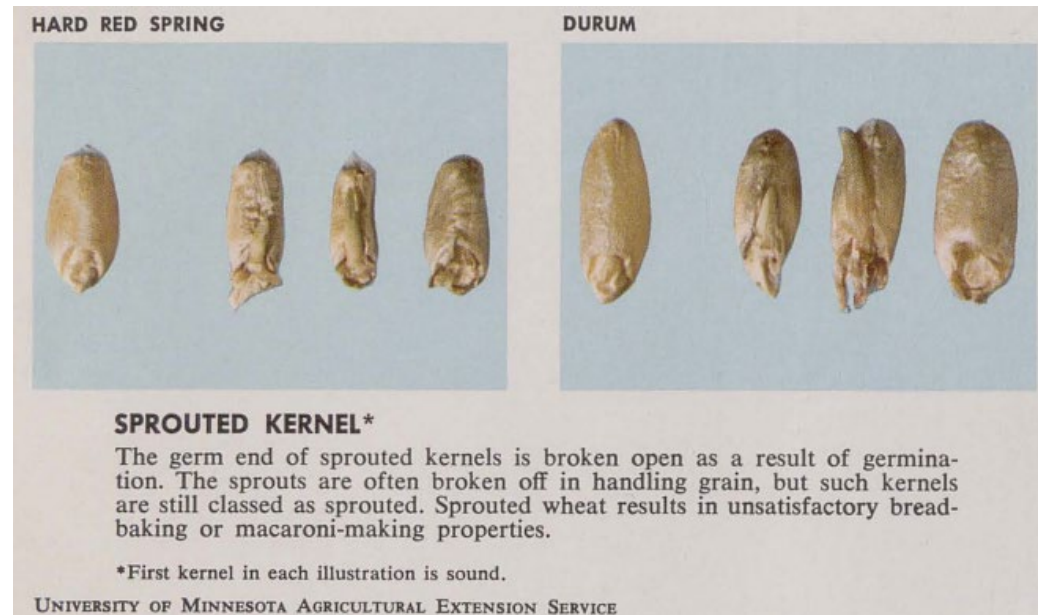
# Approaches to minimizing alpha-amylase

- Test incoming loads with a lab mill and reject those that are out of spec
- Store at low-moisture levels
  - Prevent sprouting in your possession
- Actively remove sprouted kernels during cleaning
  - Extremely difficult and limited success can be expected
  - One exception is optical sorting
    - Lab test results indicate that the use of vis and non-vis spectra (Sortex VIVV) can increase falling number (232→254)
    - Results limited since sprouts are often knocked off during transit and early-stage processing but enzymes still present in endosperm



# Minimizing alpha-amylase continued

- The additional water in sprouted grains results in a lower test weight
  - A strategy may be to take the light fraction from a concentrator and run through a gravity table
  - Then remove the lightest portion of the light fraction
- Sprouted kernels often present as shriveled kernels after they have broken open and may have partially redried
  - Adequate aspiration around impacting and scouring (with or without concentrator step) will aid in maximizing FN
  - Target 5% or more screenings out of the cleaning house





# Dealing with high sprouted wheat

- Blend raw materials to meet customer specs
- Blend finished products to meet customer specs
- Heat treat high-amylase flour to halt enzymatic activity
- Target low FN flours to customers that accept/tolerate it





# Proper storage conditions

- Shelf life of any food is always most largely impacted by two factors: moisture and temperature
- Wheat shows great long-term viability at moistures around 10%
- Above 20% bacterial growth is a problem
- Above 15% mold growth is a problem
- Above 12% sprouting can occur
- Elevated temperatures accelerate process
- Bin fans can reduce temperatures and moisture



# In conclusion...

- First line of defense is to reject the load if a screening test indicated high-enzyme load
  - Requires quick testing of incoming loads
- If forced to cope with high alpha-amylase you have options:
  - Blend raw materials
  - Enhanced cleaning
  - Blend finish products
  - Target low FN product to customers that accept it
- If moisture and temperature levels combine at high levels consider bin fans for fresh air circulation
- Have procedures and agreements with customers in place so you're not caught having to take back loads or apologizing to angry customers
- Hopefully this material can help you work with angry truck drivers or growers!

Questions?

Big thank-you to:  
Gerardo Morantes and Mike Soder, Bühler





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