Technical Bulletin

CEREALS CANADA

MANAGING SPROUT DAMAGE

Environmental conditions during harvest, particularly moisture from precipitation can cause wheat to begin sprouting. The degree of sprout damage can vary. Official definitions of sprouted kernels and severely sprouted kernels, how they are assessed and the limits for each class/grade can be found in the Canadian Grain Commission's *Official Grain Grading Guide (OGGG)*. Ways to manage sprout damaged wheat in milling and baking are included in this document.

SPROUTED KERNELS (SPTD)

DEFINITION: Sprouting occurs when kernels, which are near or at maturity, receive moisture (rain or heavy dew) which gives a signal to the kernel to begin the process of germination and the presence of alpha-amylase begins to increase. Sprouted kernels may have a swollen germ area, the bran may be split over the germ, there may be evidence of growth in the germ area, or the germ may be missing. Sprouted kernels may also be discoloured on account of weathering.

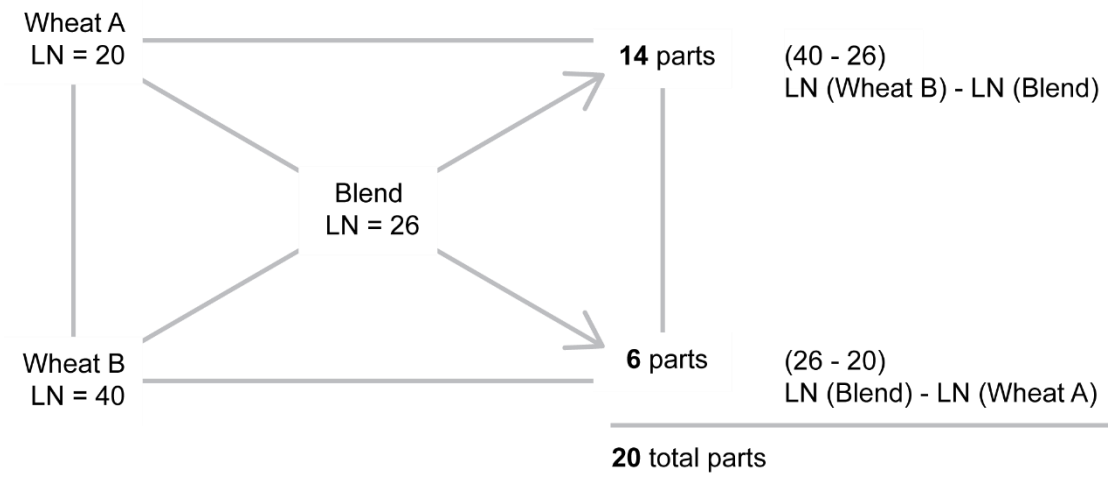
EFFECT OF ALPHA-AMYLASE: Alpha-amylase is an enzyme which degrades the starch in the kernel. In a dough, alpha-amylase breaks down the starch into simple sugars which the yeast uses during fermentation and in the early stages of baking. Fermentation, during proofing, provides gassing power which allows the dough to rise. Excessive alpha-amylase activity causes excessive starch breakdown which creates challenges in the baking process. The Falling Number (FN) test is used to provide an indication of sprout damage and alpha-amylase activity in wheat and flour while the Amylograph is used to assess the effects of sprout damage in flour. In sprouted kernels, alpha-amylase is present in high levels and will cause low FN and low amylograph peak viscosity values, both of which are undesirable. Bread made from flour milled from wheat that is sprouted can have poor dough handling properties (stickiness) during the bread making process, reduced loaf volume and poor crumb structure and colour. Flour produced from wheat with high levels of sprout damage may also negatively impact noodle colour. Semolina and pasta quality are less affected by wheat with low FN. However, if FN is excessively low in CWAD, pasta quality, including cooking loss and texture may be negatively affected.

ADJUSTMENTS - MILLING: There are several options that can be taken at the mill to potentially improve the FN of wheat or the Amylograph peak viscosity of flour milled from sprouted wheat. Sprout damage does not affect milling performance or flour ash content.

- *Reduce flour extraction rates*: remove low grade flour streams (tailings) as these streams tend to have higher alpha-amylase activity due to higher content of some germ and bran where alpha-amylase is present. These streams will also have higher starch damage which alpha-amylase will act on during baking causing excessive gassing of the bread dough which is undesirable. Removal of these streams can help increase the amylograph peak viscosity values of flour.
- *Reduce or eliminate the addition of fungal alpha-amylase*: depending on the FN of the wheat, reduction or removal of any alpha-amylase supplementation can help improve the amylograph peak viscosity values of flour.
- *Scouring*: aggressive scouring during the cleaning of the wheat can assist in removal of the outer layer of the kernel where alpha-amylase is concentrated.
- *Minimize starch damage*: ensure proper tempering to avoid production of flour with excessive levels of starch damage as this will exacerbate the problems associated with excessive alpha-amylase activity.
- *Blending*: if blending wheats with different FN, use the liquefaction number (LN; LN = (6000) / (FN - 50) to estimate the FN of the blended wheats. Since the relationship between FN and enzyme activity is not linear any blending of wheats must be done using the LN. Do not blend wheats using FN. *Note: the LN formula is for wheat blending and not flour blending.*

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- *Example:* To prepare a blend of wheat with a target FN 280 s from Wheat A (FN 350 s) and Wheat B (FN 200 s) follow steps 1-5 as shown below:
  1. Wheat A: FN 350 s → LN = (6000) / (350 - 50) = 20
  2. Wheat B: FN 200 s → LN = (6000) / (200 - 50) = 40
  3. Target Wheat Blend: FN 280 s → LN = (6000) / (280 - 50) = 26
  4. Determine the portion of each wheat that is required for the blend using Pearson's Square as shown below:



  5. Calculate the percentage of each wheat required for the blend:
     - Wheat A: 14 parts / 20 total parts x 100% = 70%
     - Wheat B: 6 parts / 20 total parts x 100% = 30%

- If you would like assistance understanding this methodology, please contact Norbert Cabral at Cereals Canada (contact information is below).

ADJUSTMENTS - BAKING: In general, flour with a FN value of 250 s should be acceptable for a no-time baking method. Bread that is processed using a longer fermentation process would require flour with a FN higher than 250 s.

- *Reduce or eliminate the addition of fungal alpha-amylase*: alpha-amylase is often added to the baking formulation to ensure the breakdown of starches into simple sugars which is required for fermentation as the yeast requires simple sugars in order to produce carbon dioxide (gassing power). Reduction or removal of alpha-amylase supplementation could prevent excessive starch degradation.
- *Reduce baking water absorption*: dough made from flour with a poor FN has poor water holding capacity and will result in wet, sticky dough that will negatively impact dough handling as the dough will be sticky. Reducing the amount of water added to produce the dough can help improve dough handling.
- *Adopt a no-time dough baking method*: this process has a short fermentation stage and includes a strong conditioner (additive) in the formulation. This should be helpful in preventing excessive starch degradation and improve bread quality.

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