

Washington Grain Commission
Wheat and Barley Research Annual Progress Reports and Final Reports

Project #:

Final Report Year: 1 of 1

Title: Defining the relationship between Falling Number and Sponge Cake

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Executive summary: Falling Number *per se* is not a wheat or flour quality problem. Falling Number attempts to predict flour quality performance in various end-uses. Our 2016 research showed that Falling Number is a poor predictor of end-use quality: cookies (low moisture) are minimally affected, whereas Japanese sponge cake quality is generally poorer with lower Falling Numbers, but there is a large amount of unexplained variation. Falling Number was originally designed to measure α -amylase, but in the context of pre-harvest sprouting (PHS). The relationship between Falling Number, Late Maturity α -Amylase (LMA) and end-product quality are poorly understood. We are addressing the following objectives:
Objective 1. Determine the effect of α -amylase and proteases on Falling Number in PHS, LMA and 'sound' grain lots.
Objective 2. Determine the effect of protein content on Falling Number in PHS, LMA and 'sound' grain lots.
Objective 3. Determine the effect of α -amylase (alone, LMA) vs. α -amylase when it is accompanied by proteases, lipases and other germination enzymes (PHS).

Impact: Growers should have tests that accurately measure the true quality and value of grain. Prior research indicates that FN may not fulfill this requirement. To move forward, we need a better understanding of α -amylase from pre-harvest sprouting (PHS) vs. Late Maturity α -Amylase (LMA), the effect of PHS beyond just α -amylase (for example proteases), Falling Number, and end-product quality

Deliverables: Accurate information as to the effect of PHS vs. LMA on Falling Number and sponge cake quality.

Part 1. Evaluating the effects of silver nitrate (AgNO_3) on poisoning the α -amylase produced in pre-harvest sprout (PHS) and late-maturity α -amylase (LMA) samples as measured via Perten Falling Number. Additionally, the effect of a protease inhibitor on the control, PHS, and LMA grain will be measured via Falling Number. Sound Diva grain (Control) and lab-sprouted Diva grain (PHS) were obtained. The Control had a Falling Number of 365 sec, the five PHS samples had Falling Numbers ranging from 93 to 295 sec. The α -amylase levels were also measured in these samples. When the AgNO_3 was added, the control was increased to 393 sec. The five PHS

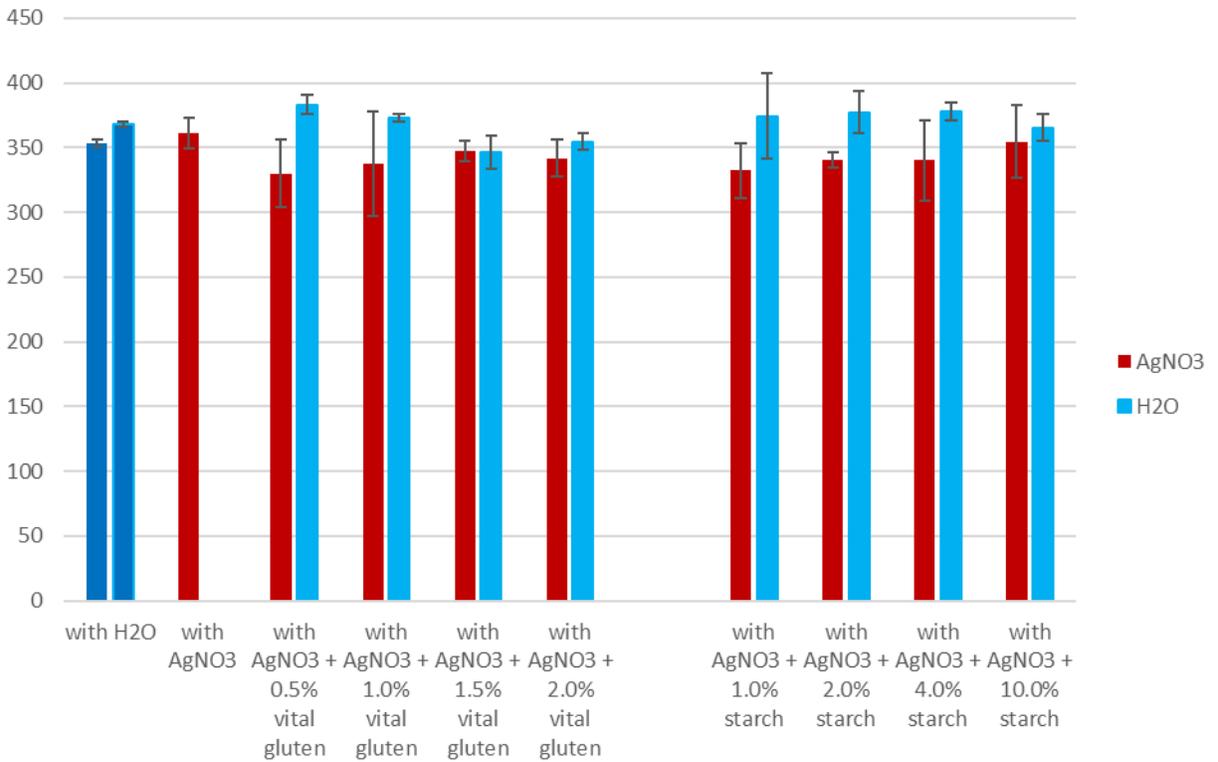
samples were increased to 365-424 sec. There was no strong correlation between the original PHS Falling Number and that after addition of AgNO₃. All PHS samples had at least an increase of 154 sec, with a maximum of 331 sec increase. See table. Clearly, silver nitrate is an effective laboratory tool to kill α -amylase.

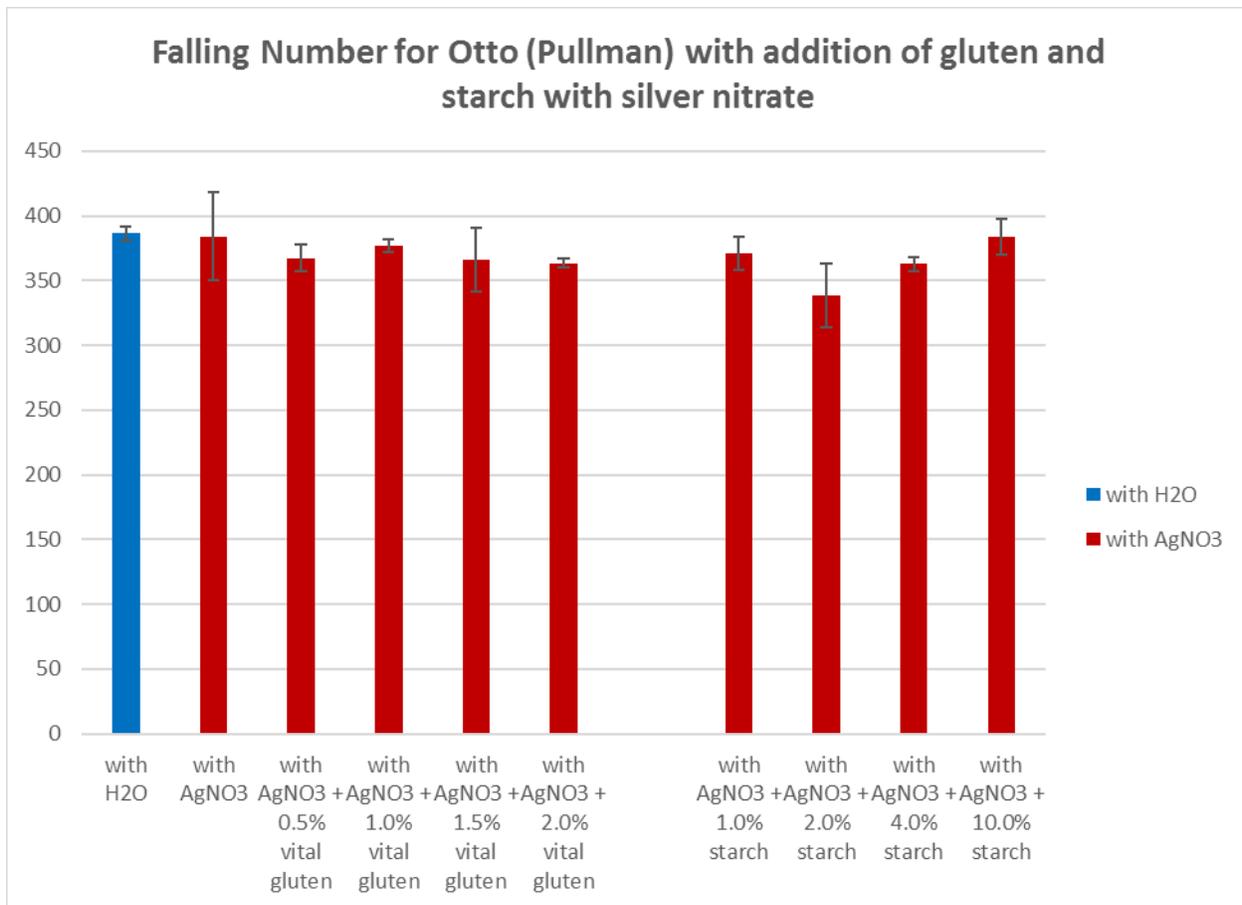
<i>Grain</i>	<i>Falling Number (sec)</i>	<i>FN after AgNO₃ (sec)</i>	<i>Increase in FN (sec)</i>
<i>Sound</i>	365	393	28
<i>PHS 1</i>	295	405	110
<i>PHS 2</i>	211	365	154
<i>PHS 3</i>	200	411	211
<i>PHS 4</i>	190	374	184
<i>PHS 5</i>	93	424	331

The lab is in the process of identifying and collecting samples that have been clearly affected by LMA. Additionally, the lab is working on the proper type and concentration of protease inhibitor to achieve the desired effect of poisoning proteases that are being produced during PHS. The lab has also added sprouted grain to control grain in levels of 0.5, 1.0, and 2.0%. The FN has been measured with and without the addition of AgNO₃. These data are currently being analyzed.

Part 2. The objective of this part is to study the effects of vital wheat gluten and purified wheat starch addition on Falling Number, along with the addition of AgNO₃ to aforementioned samples. Two varieties were chosen for this part of the project: ARS Crescent and Otto. These were chosen as popular varieties grown in the PNW.

Falling Number for Crescent (Harrington) with addition of gluten and starch with silver nitrate





The Otto samples are undergoing further evaluation to assess the FN with just the addition of vital wheat gluten and starch (without AgNO₃), as is seen for ARS Crescent. In the case of ARS Crescent, the addition of vital wheat gluten and purified wheat starch appeared to increase the FN slightly, but the AgNO₃ decreased the FN across the addition of vital wheat gluten and purified wheat starch. The inconsistency of the patterns, however, make drawing stronger conclusions challenging. Part 2. will be completed following the FN tests of Otto with just vital wheat gluten and starch addition.

Part 3. The objective is to bake cakes with the samples outlined in Part 1 and measure cake volume and the Texture Profile Analysis using the TA.XT2 (Texture Technologies). This part of the project is anticipated to begin in early spring of 2019.

Special thanks to Galina Mikhaylenko for sample preparation and analysis.