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TO: Falling Number Testing Stakeholders

FROM: Dana H. Coale /s/
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SUBJECT: Two Changes to Official Falling Number Determination for Wheat

The Federal Grain Inspection Service (FGIS) will implement a new barometric pressure correction and require the use of the Perten Shakematic for the determination of falling number (FN) for wheat grain to reduce overall variation of test results within the official inspection system effective May 1, 2019.

Background

The FN test is an indirect measurement of the amount of alpha-amylase activity. High alpha-amylase activity is associated with sprout damage and adversely affects the end-use quality, and consequently, the value of wheat. As a result, the assessment of this factor is important in the domestic and international trade of wheat.

The FN test is an internationally standardized method and the most widely accepted means for evaluating alpha-amylase activity. The FN test assesses the viscosity of a slurry of ground wheat and water that is heated in a boiling water bath by measuring the time it takes for the instrument to mix the sample with a viscometer-stirrer rod, release the rod, and allow it to fall through the heated slurry. The viscosity and FN value are inversely related to the amount of alpha-amylase activity. A low FN indicates low viscosity of the sample and high alpha-amylase activity, and vice versa. A minimum FN of 300 seconds is a common contract specification in domestic and international wheat markets below which discounts are commonly applied.

In 2016, industry stakeholders requested FGIS reduce the variation in the FN test. In response, FGIS identified two opportunities to reduce overall variation in official FN testing: 1) implement a new correction to sea level conditions using the measured barometric pressure and 2) require the use of a robotic sample shaker, the Perten Shakematic 1095. In October 2018, the Grain Inspection Advisory Committee (GIAC) endorsed these changes. The GIAC is a committee representing all segments of the grain industry and is appointed by the Secretary of Agriculture to assist FGIS in better meeting stakeholder needs.

Correction of FN to Sea Level

Currently, official service providers of the FN test are located at elevations from zero feet to approximately 3300 feet within the continental United States. Correction of FN to sea level is performed to compensate for the effect of elevation on FN. An increase in elevation leads to an increase in FN due to the change in barometric pressure and its effect on the boiling point of water. However, FN values are currently corrected to sea level only for testing locations at elevations 2000 feet or above. To reduce variation among laboratories, correction to sea level is also needed at locations below 2000 feet.

FGIS engaged with the Agricultural Research Service (ARS) to develop a new mathematical model for correcting FN to sea level using barometric pressure that simulates elevations up to 5000 feet. ARS published the study in March 2018 (Cereal Chem. 2018, 00, 1–8). The use of barometric pressure is preferred over elevation as it is the factor that directly affects the boiling point of water.

FGIS will implement this new correction to reduce variation between labs. The new correction may result in up to 6% lower FN values for official service providers that start correcting to sea level (elevations at less than 2000 feet). However, applying the new correction at elevations 2000–3300 feet may result in slightly higher FN values after correction (e.g., 1–3% higher for a FN of 300 seconds and 6–8% for a FN of 200 seconds). Official service providers will be required to use either a Testo 511 barometer (Catalog No. 0560 0511, Testo, Inc.) or Fisherbrand Traceable Digital Thermometer (Catalog No. 14-650-118, Fisher Scientific).

Use of the Shakematic

FGIS procedures currently allow for shaking samples either by hand or by robotic shaker, the Shakematic 1095 (Perten Instruments), prior to placing the sample in the FN instrument. Through a side-by-side comparison of the two shaking methods, FGIS determined that use of the Shakematic eliminates analyst fatigue and provides more consistent mixing. Use of the Shakematic generates slightly lower FN values than handshaking (3–5%) but is already in use by most official service providers. Therefore, FGIS will require the use of the Shakematic to eliminate this difference, resulting in more consistent FN results between official service providers.

Implementation

FGIS will implement the use of the barometric pressure correction and require the use of the Shakematic effective May 1, 2019, to ensure higher FN accuracy for the 2019 harvest. While some FN values could go down as a result of these changes, FN results will be more accurate and uniform across the marketing chain from farm to export. The May 1, 2019 implementation date also provides official service providers time to purchase the Perten Shakematic 1095 (\$5,000 each) and FGIS-specified barometers (\$80–\$200 each), if not already in use. All Service providers will need to ship their barometers to the Technology and Science Division to verify the accuracy prior to use and every 2-years thereafter.

FGIS plans to issue updated instructions on performing the FN test and provide training to official service providers by February 15, 2019. The updated instructions will include the barometric pressure correction, requirement of the Shakematic, and some additional quality control procedures.

For more information regarding these changes, please contact the Analytical Chemistry Branch at 816-891-0401 or FGISACB@ams.usda.gov.