**Impact of Surface Moisture on Reflectance NIRS Measurements of Grain Properties**

ISU Grain Quality Laboratory

Surface moisture from condensation or rain may impact the accuracy of NIRS composition data collected in the field with an on-combine reflectance NIRS unit. This is the design of an experiment to determine if surface moisture does impact NIRS results, and if yes, what calibration modifications could mitigate that effect. We will attempt to simulate various surface moisture conditions in the lab by misting cold grain and repeatedly scanning the undisturbed grain until it reaches 5C of the room temperature

Considerations:

The surface of the grain could be wet, and, if the NIRS unit is separated from the grain by a window, the window could have liquid water on it. To separate those effects, one test could be done with a unit that looks at the sample surface without a glass separation (Perten DA7200), then one with a unit that looks through a glass at the samples (Zeiss Corona).

Misting the grain for open sample presentation is relatively straightforward because the NIRS is looking directly at the grain that was misted with no disturbance. Looking up through a glass cup is more complicated because the misted grain must be handled once to put it in the cup and then water could be on the glass as well as the grain. In field operation, most likely a glass window will be used, so the first test should be the one with the window.

The grain is to start cold; therefore the misting and loading of the cup should be done in the refrigerator. The cup itself should be a low mass as possible to avoid thermal transfer. We should use the glass dish and the standard Zeiss Corona rather than the harvest labs that have a large custom made bowl.

The glass bowl holds about 300 grams of grain, full. It needs to be full to prevent light pass through. If we spray on 3 grams, 1% point increase in moisture. 6 grams = 2% points, etc. Water can be added by weight to the grain in a large pan. Unless we had a mechanical balance, the water addition would have to be done outside the cooler, mixing and filling inside.

Fill the bowl in the refrigerator; then progressively scan it in the lab Corona. Take the temperature looking up at the bottom of the bowl.. The process should generate scan data such that, if needed, it could be added to the calibration.

**Process:**

1. Identify 10 clean soybean samples with a reasonably wide range of composition, and weighing at least 1000 grams. Get a baseline composition from the Infratec and GAC2500. Then refrigerate in bottles at ~ 4-5C. Mix well.

For each sample:

1. Fill the Corona bowl, in the cooler.
2. In the lab, take the temperature looking up at the bottom. Scan the sample in the bowl. Remove the sample. Weigh the bowl.
3. It should warm up in the room. Wait 5? Minutes.
4. Repeat 3 and 4.
5. Continue to nearly room temperature.
6. Scan data and predictions on the most current JD calibration will be saved. This is the baseline with no surface water.
7. From the same bottle in the cooler, weigh out enough grain, in a pan, to fill the bowl and then some. Mist on 2% points by weight of water (pan on scales). Fill the bowl immediately in the cooler.
8. Repeat steps 3, 4, 5 and 6. Recombine the sample.

Continue for all 10 samples. Assemble data and evaluate changes in predicted values and scan data on a sample by sample basis , then in the aggregate. Decision point for more testing. The change in weight monitors the actual drying that happened over the test period.

If the changes in predicted values are significant ???not sure how much?? Then additional data for soybeans, and data for corn and wheat, would need to be collected for inclusion in the calibration. If not then, the calibration can continue as done.

**Testing Temperature Stabilization of the Instruments**

We will need to do a similar test for instrument temperature conditions, to prove that the internal temperature stabilization is working. If that test indicates an impact then a sample set will need to be collected for inclusion in a calibration update. We can use the same 10 soybean samples as a starting point. Question: can we assume that using an original Corona will be representative of the Harvest Labs?. The original Corona is much easier to move and is not part of the JD Harvest Lab data collection network.

We will also assume for the starting point that the instrument and grain are at the same temperature. The most likely interactive combination in the field would be cold grain and warm unit.

Process:

1. Put the Corona on the work bench in the cooler. We may have to keep the computer outside and run a wire under the door. Screen inside with wireless keyboard and mouse.
2. Refrigerate the 10 samples.
3. Run them in the unit, with both grain and unit cold. Record scan and predicted values.
4. Take the temperature looking up at the bottom. Remove the sample to the warmer room Wait 5? Minutes.
5. Continue until nearly room temperature.
6. Go to the next sample. Recombine the samples. Return them to the refigerator
7. Put the Corona in a warm cabinet (~45-50C)
8. Repeat 2, 3 and 4. Recombine the samples and put them in the warm area with the unit
9. Run them in the unit, with both grain and unit warm. Record scan and predicted values.
10. Take the temperature looking up at the bottom. Remove the sample to the cooler room Wait 5? Minutes
11. Continue until nearly room temperature.

Assemble data and evaluate changes in predicted values and scan data on a sample by sample basis , then in the aggregate. Decision point for more testing.