Image Processing Application Update

Brian Luck, University of Wisconsin

Over the past few years we have been working to develop a method for assessing particle size distribution of processed corn kernels in whole plant corn silage via image analysis techniques. We have shown the method is feasible and would be easily implemented in a smart phone application (app) format. This format would allow farmers to check the operation of their kernel processors with a repeatable method rather than visually assessing kernels. Data collected from a high resolution camera compared to the smart phone camera showed little to no difference in assessing kernel processing scores. The app has been developed as a beta testing version; we are working toward being able to release the final version available for Apple and Android devices. Here is a quick overview of the app's functionality and the materials required to check the kernel processing score of your corn silage in-field during harvest.

Steps to use the app are fairly simple. Materials required:

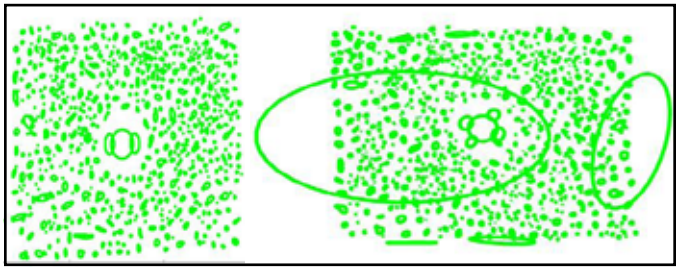
1. Whole plant corn silage samples; preferably enough to make three sub-samples of approximately 5-6 grams of corn kernels.
2. Smart phone with camera and the Kernel Size Analysis App installed.
3. Plastic container and water for hydro-dynamic separation of kernels from plant material.
4. Paper towels for drying corn kernels after separation.
5. Dark background – anything from a rubber truck bed liner to a black sheet of construction paper. Remember, the more uniformly dark the background (i.e., no paint chips, specks in the image) the better the measurement results will be.
6. Common U.S. coin (penny, nickel, dime, or quarter).

Once you have these materials, the steps for checking particle size distribution of processed corn kernels are:

1. Collect your corn silage samples.
   a) The simplest place to do this is the unloading/storage site.
   b) Be sure to randomize samples as much as possible, pulling them from different areas and depths from the unloaded pile.
   c) Pull three samples from the pile each equaling ~12 oz in volume (about the size of a red solo cup or two large handfuls).
2. Hydro-dynamically separate kernels from plant material within each sample. You can refer to the *"Making Sure Your Kernel Processor Is Doing Its Job"* article on the fyi.uwex.edu/forage/making-sure-your-kernel-processor-is-doing-its-job/ website for detailed steps on doing this properly. The goal is to float away plant portions of the corn silage leaving kernel portions in the bottom of the plastic container. Make sure to keep kernel portions from each sample separate.
3. Blot dry corn kernels with paper towels – it is not necessary to remove all the water entirely.
4. Spread kernels evenly on the dark background – it is not necessary to ensure kernels are not touching one another. If you see a few instances where this is occurring, separate them as the image processing results will be more accurate.
5. Place the coin in the center of the image.
6. Start the smart phone app and take the picture.
7. Repeat steps 2-6 for the other two samples to ensure accurate results.

Initial results provided by the app will be a green "Good" indicator or a red "Bad" indicator. If more than 30% of the particles in the image are larger than 0.187˝, the app will indicate a "bad" reading. This is the same threshold currently used to determine kernel processing score. If you are questioning whether the app is correct, there will be a "More Information" button allowing you to view the processed image, mean particle size, and descriptive statistics for the recorded image. If you view the processed image and find the software considered a large portion of the image as a single particle (Figure 1) or that many particles were touching and not considered individually, you should re-run the software on a new image. These errors can also be caused by excessive glare, so try not to use shiny backgrounds or shade the area when possible. If all three samples return "good" indicators from the app, your kernel processors are set correctly. If more than one sample returns a "bad" indicator, you may consider adjusting kernel processing rollers to a smaller gap and test again with the software.

Figure 1. Image analysis results of kernel processing score. Good image analysis results from the app (left) show many individual particles; bad image analysis results from the app (right) show large circles caused by glare in the image.



While this smart phone app will not replace having lab analysis done on your harvested corn silage, it will provide an in-field assessment of kernel processing score during harvest allowing you to adjust the machine to ensure high quality feed is being produced. Look for the app to be released in early 2017.