

Q&A: Researchers make progress on new tests for starch quality in wheat

By **MATTHEW WEAVER**
Capital Press

New tests for starch damage in wheat are on the horizon as researchers seek a more reliable alternative to the falling number test that is commonly used.

Those efforts got a shot in the arm last summer, when Ashley Cannon joined the USDA Agricultural Research Service in Pullman, Wash., as a research molecular biologist. Cannon studied secondary dormancy as a post-doctoral student, giving her insight into seed development and germination.

She joined USDA research plant molecular geneticist Camille Steber, who with researchers Amber Hauvermale, Andrew McCubbin and Michael Pumphrey designed a new test called an Enzyme-Linked Immunosorbent Assay, known by the acronym ELISA.

It can measure the amount of alpha-amylase in flour samples. Late maturity alpha-amylase is an enzyme that causes starch degradation in wheat.

They have teamed up with an industry partner to increase the sensitivity and speed of ELISA.

In addition, Washington State University researcher Zhiwu Zhang and former graduate student James Chen have been developing another test that combines hyperspectral imaging and machine learning.

The commonly used falling number test measures starch damage in wheat. Technicians determine how long it takes two pins to fall through a ground wheat-water slurry, measuring its viscosity. Wheat with a low falling number has starch damage and is sold at a dis-

count because it can reduce the quality of baked goods and noodles.

Farmers were caught off guard in 2016 when 44% of soft white wheat samples and 42% of club wheat samples tested below 300, the industry standard. The industry estimated the damage that year cost farmers more than \$30 million in lower wheat prices.

Low falling numbers can be caused by pre-harvest sprouting due to rain or by late maturity alpha-amylase occurring as a result of large temperature fluctuations during late grain filling.

Cannon and Steber spoke with the Capital Press March 18 via Zoom.

The interview has been edited for length and clarity.

Capital Press: What does having Ashley on board add to research efforts? What can you do now that you couldn't do before?

Steber: When the funding first came in for falling numbers through USDA, I was asked what I needed help with. I said, "There is a lot of pressure to improve upon the falling numbers test, and I'm being stretched in the direction of 'biochemistry,' things I hadn't done before.

So I'm really glad to have her expertise. When we did that job search, I was looking for a partner in crime and I think I've found her.

CP: Is it hard to get a handle on what falling number is?

Cannon: The test itself is actually pretty straightforward. I think we're still learning about how those test results can actually translate to what we see in the grains themselves. ...

I think the part that keeps coming up, though, is there's so much variability in the test. That may have nothing to do with science. That's the part that I think none of us can really get a grasp on, unfortunately.

CP: If it may have nothing to do with science, then what's the problem?

Cannon: I think some of it has to do with users. It's not really user error, at all. It's just the way each of us approaches



Capital Press File

Wheat is harvested in Washington state's Palouse. Researchers are developing wheat quality tests that will be more accurate and reliable than the falling number test.

the technique. Each person who does a falling numbers test introduces some level of difference that could result in an error.

The things that are contributing to the gelling capacity are just a lot more complex than people like to let on. It's not just, "Was there alpha-amylase or was there not?" There's a lot more going on chemically that could lead to a lot of differences in the gelling capacity of that mixture in the test.

CP: How can a new test address what you're talking about?

Cannon: The falling numbers test, unfortunately, although it works well to give us an answer right now, isn't always a true reflection of end-use quality.

Steber: It's used by the industry as a risk assessment tool.

Cannon: The research is really there to show that sprouting grain unfortunately has bad end-use quality, generally. If we use the ELISA ... our confidence in the predicted end-use quality goes up. I think that's the advantage of that test.

The other test, hyperspectral imaging ... can tell us, hopefully long-term, what a predicted falling number would be, but also perhaps what is the cause of a predicted, relatively low falling number. Is it sprouting or late-maturity alpha amylase and based on that, what is the actual predicted end-use quality? Collectively, it increases our confidence that

we actually know whether this grain is going to result in good or bad end-use quality, and it reduces unnecessary losses to farmers.

CP: One of the complaints we hear about the current test is that you can't replicate it because the sample is destroyed in conducting the test. Would these other tests address that?

Cannon: Hyperspectral imaging is not destructive, so that's really exciting. We can test the same grain more than once. That in itself increases confidence. If a farmer says, "I don't agree," just test the grain again.

The ELISA, unfortunately, will require destruction of the sample.

Steber: We have a struggle in that critical range from 250 to 300 seconds, there is a great deal of grain-to-grain variation.

If I say, "Here, I have this bag of wheat, and it's 270," if I were to go through and take out little aliquots of 10 grains each, and check the enzyme levels, I could get wildly different numbers. ...

That variation is going to exist whether I'm running a falling numbers test, an immuno assay (ELISA) or a hyperspectral assay.

With the hyperspectral assay, Ashley is actually going to take things to the point where she can measure alpha-amylase on single grains.

That means we'll literally get a picture of what's going on, assuming that everything goes as we've planned.

You'll see what the cumulative falling number alpha-amylase level is likely to be, and you'll also get an idea of the degree of variation in that sample.

CP: Would both tests replace the existing test?

Steber: An immuno assay (ELISA) at this point is a sure-fire approach. It means we will get it to work. It's scientifically clear we will get it to work.

The hyperspectral imaging, we are still in the exploratory stages, so I hope we will get it to work. Keep your fingers crossed for us, please.

CP: What kind of a timeline is

there to move from the current test, with its issues, to something that's more solid?

Steber: Well, there are two things that have to happen, right? The science and adoption within the industry.

We actually just wrote a pre-proposal to (the Foundation for Food and Agriculture Research) for a project that includes not just the science piece, but also the outreach piece for adoption. We think that's going to be critical.

It's likely that adoption is going to be gradual once we have the tool in place.

It's going to be a long time before our foreign buyers think that they will trust a new test. It's a matter of coming to trust it. But I think the role it can have early on is in identifying problems earlier, before we start mixing low- and high-falling number grain.

I think it will have a role at the elevators and you never know, it may even have a role for farmers when they harvest different fields, so they know that they need to be careful not to mix grain from one spot with grain from another spot, because they can see that they have wildly different falling numbers.

Cannon: Another way to think of it that I think farmers will be really happy to hear is I think breeding programs will be able to use it. It's really going to prevent the release or even breeders pushing varieties through that have low falling number, or that have a particular cause of low falling number. Farmers can rest easy thinking that in coming years breeders are going to be releasing varieties that have more stable falling numbers.

Steber: This is a job for Ashley and I, to develop these screening techniques for the breeding programs and teach them. Because the falling numbers test requires expensive equipment, takes up a lot of space in your lab and it's very low throughput.

Those things don't add up to early selection against the problem in a breeding program. They add up to "OK, let's see if we can catch it just before it goes out the door."



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The importance of telling agriculture's story

By Cole Baerlocher and Alissa Whitaker

If not us, then who? A question we all need to ask ourselves when it comes to advocating for the agriculture industry. If we do not step up and share the stories of hard-working, dedicated producers here in the state of Washington, then who will?

Alissa Whitaker and I were given the opportunity to share the story of agriculture in celebration of National Agriculture Day. Together, we went through three advocacy training sessions with the National FFA Organization that allowed us to gain insight into the art of storytelling and the importance of literacy; specifically, agricultural literacy.

We joined over 80 other students from across the nation representing other student-led agriculture organizations from 4-H; Agriculture Future of America (AFA); and Minorities in Agriculture, Natural Resources, and Related Sciences (MANRRS).

On Tuesday, March 23, we met with Rep. Kim Schrier, as well as aides from both Sen. Maria Cantwell and Sen. Patty Murray's office. These meetings gave us ample opportunity to advocate for the importance of rural broadband, alternative energy and equity, diversity and inclusion within agricultural education.

We understand the importance of legislators hearing from leaders, young and old, about the issues we are currently seeing as constituents in Washington state.

National Ag Day provided us with opportunities to connect with our lawmakers, all while learning from each other about the future of agriculture.

Celebrating and recognizing the contributions of American Agriculture is extremely important, and advocating for our industry must take place year-round. The skills we learned as we partook in National Ag Day will be carried with us as we live our daily lives as state officers and beyond.

While we may have celebrated National Ag Day on March 23, we are all aware that the work doesn't stop. We must continue to share and advocate to the audiences we can reach.

We all know that story-telling is powerful, and advocating is important. What is holding us back from taking the step and sharing our story? Everyone has a story worth telling — what's yours?




Alissa Whitaker is the 2020-2021 Washington FFA State Treasurer, and Cole Baerlocher is the 2020-2021 Washington FFA State President.

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