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Searching for answers

FODMAP levels show no relationship to breeding

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Continually Still

A downward trend in U.S. wheat flour consumption from 146.3 pounds per capita in 2000 to 132.1 pounds per capita in 2018 is a concern for wheat farms across the region. If this trend continues, it may have negative consequences for the entire wheat industry.

While the removal of starches in recent fad diets have been a large contributor to that trend, concerns remain about wheat consumption among those with celiac disease, gluten sensitivity, wheat allergy to the protein and non-allergy-no-celiac wheat sensitivity.

"For those who are not impacted by the gluten, the question becomes 'what is causing the sensitivity?'" said Dr. George A. Annor, University of Minnesota assistant professor of Cereal Chemistry and Technology. "We think the sensitivity could be coming from FODMAPs and ATIs."

FODMAPs, or fermentable oligosaccharides, disaccharides,

monosaccharides and polyols, aka short-chain carbohydrates (sugars), can also be found in foods other than wheat, like rice, fruits and vegetables. Most people are able to tolerate FODMAPs lower than 0.3 grams per serving, which Annor said would amount to about two slices of bread.

With hopes of increasing wheat consumption in the future and reducing discomforts resulting from wheat-based products, Annor and UMN Professor of Wheat Breeding and Genetics Dr. Jim Anderson are analyzing a diverse panel of 220 wheat lines to determine if they can breed wheat lines to reduce levels of FODMAPs and ATIs (Amylase Trypsin inhibitors), an inhibitor of starch and protein digestion.

To do this, they have taken ancient, heritage and modern wheat varieties grown in Minnesota plots to identify specific genetic markers for FODMAPs and ATIs.

So far, Annor has determined the different sugars and specific fructans on wheat varieties to quantify the FODMAPs in each variety sample.

"There is a wide variation in some samples," Annor said. "Even though they look very small as they are all below this 1.6 percent, if you go back to the fact that some people need below 0.3 grams per serving, these values are still significant."

Anderson has compared his own DNA fingerprint of each variety to Annor's FODMAP data to develop a picture of which specific genes or genome region(s) are responsible for FODMAP variation. He said the data has shown that there are a few genes on different chromosomes affecting FODMAPs.

"While it is a preliminary result, it does show us that the trait is under complex genetic control," Anderson said. "We were hoping to get lucky and maybe find one or two genes controlling the trait. That would make it easier and faster to breed for reduced FODMAP levels. But it looks like it is going to be a complex trait based on this early analysis."

On a positive note, the data demonstrates there is no trend of a higher number of FODMAPs in more modern wheat varieties versus their heritage or ancient grain counterparts. Anderson said it is reassuring to know regional programs have not inadvertently been increasing FODMAP levels through breeding.

Beyond FODMAPs, Anderson and Annor have yet to explore ATIs.

"Based on the literature that I'm familiar with in this area, I think the ATIs are maybe going to explain some of these issues more than the FODMAPs actually do," Anderson said. "And then we also have the processing to look at and the effects of different fermentation on FODMAP and ATI activity in wheat food products."

Anderson and Annor continue to move forward with their multi-year research project that is funded through the Minnesota Department of Agriculture's Agricultural Growth, Research, and Innovation (AGRI) Grant, in collaboration with the Minnesota Wheat Research and Promotion Council, the Agricultural Utilization Research Institute and Back When Foods.