Peas have been part of the human diet for millennia, proving to be an important source of protein, carbohydrates, and several micronutrients. It’s not just their nutritional value, though; growing peas has several other benefits.

For instance, bacteria living in root nodules of pea plants fix nitrogen from the atmosphere, making it available for plants, which reduces the amount of fertilizer farmers have to apply. That, in turn, lowers energy costs and greenhouse gas emissions from fertilizer manufacturing and crop production.

“Pea is an excellent rotation crop with wheat,” says ASA and CSSA member Chengci Chen, a researcher at Montana State University. “It helps to control weeds, diseases, and insects in the rotation system.”

According to Chen, pea–wheat rotation systems are producing higher yields and more net returns than traditional cereal mono-cropping in the Northern Great Plains of the United States. Farmers across the region are actively switching from traditional cereal mono-cropping systems to pea–wheat rotations. But many unknowns remain.

How well a specific cultivar of pea performs depends both on its genetics and the environment it is being grown in. In a recent study published in *Agronomy Journal* (http://bit.ly/2vxzy83), Chen and his colleagues examined how these genetic and environmental factors affect pea yield as well as protein and starch content.

It’s important to understand how both genetics and the environment affect pea crops because environmental conditions can vary tremendously across the vast areas covered by the states in the Northern Great Plains. For instance, Montana, the largest...
producer of dry peas in the United States, stretches more than 550 miles from east to west—greater than the distance between Columbus, OH, and New York City—and more than 320 miles from north to south, and it has a wide range of temperature, rainfall, and soils.

A pea cultivar that thrives in one part of Montana may perform poorly in a different part of the state because of these differences in environmental conditions. Growers need to know which cultivar of pea will have the best chance of success in the area they are farming.

That’s exactly what Chen wants to help with, and to do that, he and his colleagues grew nine different cultivars of pea in five different locations across Montana. These locations were spread across the state and had different soils and climatic conditions. They measured yield as well as protein and starch content of each pea cultivar grown in the five locations over two years.

They found that yield and protein content were affected by both genetics and the environment, but about 93% of the variation in yield and more than 92% of the variation in protein content of peas grown in different locations could be explained by differences in environmental conditions such as rainfall and temperature.

They also found that some cultivars have site-specific adaptations while others have wider adaptations to different environments.

The researchers measured two different aspects of the starch content of the pea cultivars grown in different environments: total starch and resistant starch. Resistant starch is “a type of starch that is not digested in the small intestine,” Chen explains. Instead, it is fermented by intestinal bacteria in the large intestine into short-chain fatty acids, which can be absorbed by the colon or provide energy to the gut microbiota.

Chen’s interest in the resistant starch found in peas stems from its benefits to human health. Since resistant starch does not release glucose within the small intestine, it can reduce the glycemic response to foods, which is helpful for everyone, and especially for individuals with some metabolic diseases, such as diabetes.

“In contrast to yield and protein content, resistant starch content of peas is mainly controlled by genetics,” Chen says.

According to Chen, the findings of this study can help guide farmers in selecting pea cultivars for higher yield or the desired protein or starch content when grown in specific environments. “Pea cultivars that have higher yield can obviously bring more profit to producers, and cultivars that have higher protein or starch contents might be of interest to different end-users,” he says.

For example, in recent years, dry yellow peas have been fractionated into protein, starch, and fiber, which have been widely used as ingredients in products for the health food market. “Pea protein is preferred by many consumers because it is non-dairy, allergen-friendly, and has high lysine content,” Chen says.

Chen and his colleagues continue to work with plant breeders to develop and test new cultivars that can adapt and produce higher yields with desired end-user characteristics and nutrition values. He is also developing agronomic management strategies to overcome limiting factors and allow pea to thrive in different environments in Montana.