**Modern plant breeding– use of precision tools to meet the need of sustainable and healthier crops**

We are facing a number of global challenges, and plant breeding can contribute to solve some of them by providing crops better adapted to human needs and environmental conditions. Crop innovation can for example lead to a resource use efficient and sustainable agriculture, deliver products with improved or novel end-use qualities and provide healthier foods, addressing important challenges like the climate change, a growing population and finite natural resources. We need to act now and swiftly, but developing new crops takes time. A number of methods that we can use for plant breeding are in our hands, and the implementation of new techniques as well as improving existing ones is running in high speed. Today, we can choose the technology that fits best for the trait we want to develop. I use molecular biology methods in my work for research as well as development of crops with novel traits. These molecular methods can sometimes be quicker compared to conventional methods since one or a few traits can be added directly to an elite genotype. In addition, these techniques might be the sole alternative to achieve a certain trait, when breeding through sexual crossings is not an option. On the other hand, current legislation makes the release of plants developed by some of these methods uncertain. Recent discovery and development of a method called CRISPR-Cas9, has had a large impact on research among a wide variety of organisms. My research group have implemented and further developed this method to become an efficient tool for research and breeding of potatoes. We now use the method to mutate and tailor genes to answer research questions and obtain new potato traits.

My research is mainly about improving the quality of the plant storage products starch, oil and protein, where potato and starch has received a lot of my focus. Besides water, starch is the most abundant component of the potato, but unfortunately, it provides a high glycemic index (GI) when eaten. A potato with starch that is digested more slowly or partly resistant to digestion, would be beneficial for our health and would control blood sugar levels and body weight. Starch consists of two molecules, amylose and amylopectin, at a distribution of about one to four. Of the two molecules, amylopectin is solely responsible for the high GI. By mutating two genes in potato involved in the building of amylopectin, we have created a starch that looks and behaves more like an amylose. The starch has thus become a slow and resistant carbohydrate instead of a fast carbohydrate. This high-amylose starch has also been proven to have favourable properties as a raw material producing bioplastics, a renewable product that could replace some plastics produced from fossil oil.

Starch is a bulk product used as pastes in many food and industrial applications. In Sweden and northern Europe, potato is the main crop grown for starch extraction. A paste of native starch has, in most applications, often an insufficient storage stability, and is therefore chemically modified to become more stable and to increase product quality and shelf life. Amylose is the molecule responsible for this low storage stability. By mutating the gene responsible for the synthesis of amylose, we have produced potatoes with pure amylopectin starch. This starch has a natural storage stability and requires no post-harvest chemical modification, which will have large environmental benefits once grown for production.

My driving force in research is to help creating a better world for the generations to come, by using applied research leading to forefront crop innovation. I aim to further develop and use methods for breeding crops with improved characteristics that will make a difference; reducing the environmental impact, optimizing use of cultivated land area by providing crops with additional valuable components, catering for highly nutritional plant proteins to the ongoing protein shift, slowing down the climate change and providing healthier foods.