Student Success Story - Celeste Falcon

After graduating from Cornell University in 2011 with a BS degree in Plant Science, I began working on my PhD in Applied Plant Sciences with Dr. Kevin Smith at the University of Minnesota. I am currently in my second year and am working on two projects. My research interests are in using breeding methods to improve crops in terms of their nutritional quality and adaptation to lower input systems.

For my first project, we are attempting to discover new alleles within a panel of elite breeding lines for improving nitrogen use efficiency (NUE) in barley. We are interested in this trait because the production and overuse of nitrogen fertilizer have negative environmental effects, and, as CO_2 concentration increase with global climate change, it will be more difficult for small grain crops like wheat and barley to take up nitrates. Because the malting and brewing process requires barley with an intermediate level of protein, the eventual goal is to create barley lines which maintain the optimal level of protein while having increased yield and decreased need for nitrogen fertilizer. Along with our TCAP collaborators, we have collected phenotypic data for a number of traits related to yield and protein in low and normal nitrogen application treatments. Indices comparing the performance of each line under these two treatments will be calculated as a measure of NUE, and these calculated values will be used in association mapping to discover useful alleles associated with NUE.

For my other project, we are looking at how well genomic selection can be implemented into a breeding program. Specifically, we seek to increase the low temperature tolerance of facultative malting barley lines to create a crop that can be planted in the fall, withstand Minnesota's harsh winter weather, and be harvested in the early summer. For this project, we will report accuracy in predicting the performance of progeny, gain from selection and maintenance of genetic variation comparing these values for phenotypic and genomic selection. We will also identify changes in allele frequency for several genes known to affect winter survival traits and look for other genes which have changed drastically in terms of allele frequency indicating that they may also be associated with winter survival. Proving the utility of genomic selection in the context of a breeding program is an important step in encouraging the use of this method.