

BRE1516: Application of Genomics to Innovation in the Lentil Economy

Canada is the world's largest producer and exporter of lentil (*Lens culinaris*). Since 1997 Canada has produced 18 million tonnes of lentils, worth more than \$14 billion in export value. This success is largely due to advances in plant breeding at the University of Saskatchewan. Annual yield gain has been more than 3% since 2001 when the first of the Canadian-bred lentil varieties proceeded to commercial production. Due to local adaptation and grain quality constraints, however, breeding programs typically rely on a narrow range of germplasm. This strategy hampers the genetic gain over time. Limited genetic diversity in the Canadian lentil breeding program will soon impede its ability to meet the demands of this growing industry. AGILE will tackle the problem by enabling breeders to develop better lentil varieties through systematic use of diverse cultivated germplasm and wild relatives from the genus *Lens*. The project outcomes will be vital in enhancing productivity and quality of Canadian lentils and in ensuring sustainability and long-term prosperity of the industry. In this project, we will first characterize the genetic variability available within the primary and secondary gene pools of genus *Lens* through genotyping and phenotyping. The information will be used to determine the genetic basis of the contrasting adaptation characteristics of lentils from the three main growing regions. We will then develop breeder-friendly markers for tracking response to photoperiod, temperature, and light quality, and generate resources and tools to allow breeders to better use exotic germplasm and wild relatives while reducing any negative impacts. The systematic study of symbiont diversity will allow for a better understanding of ways to improve the nitrogen fixation process in lentils. Access to superior cultivars does not automatically translate to adoption by farmers, particularly if they are unfamiliar with lentil crop production. Numerous factors influence crop production decisions, and a clearer understanding of these will help increase producer uptake of this important crop. Our GE3LS research will identify the various factors that may influence producer decision making processes and propose a strategy for effective communication and knowledge exchange/transfer, which will encourage sustainable and profitable production of lentils in Canada.