

Title: Eliminating Allergy-Inducing Proteins from Wheat Flour

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Abstract: Wheat is one of the world's most important staple crops. However, a significant proportion of the US population (1% or 3 million people) cannot consume wheat products because they suffer from celiac disease, an allergic reaction to some seed storage proteins in wheat flour (Fasano et al. 2003). A subset of seed storage proteins known as the gliadins have been identified as the allergy-eliciting agents and previous studies have shown that removal of gliadins from flour or dough yield food preparations that are tolerated by celiac disease patients. Thus, wheat devoid of gliadins in the grain would be a widely accepted food alternative for celiac patients. In addition, gliadin-free wheat has the potential to permeate all areas of the gluten-free market due to its versatility as a food ingredient.

There are a number of strategies that have been proposed to produce wheat with reduced or absent immunogenicity (allergenicity). These include mutagenesis, selective breeding, cytogenetic manipulation of chromosomes, and genetic modification. Given the number of gliadin genes (25 to 100) and chromosomes (6) that harbor them, the one-gene/chromosome-at-a-time approach of mutagenesis, cytogenetic manipulation, and selective breeding will not be as efficient as an approach that eliminates all gliadins simultaneously. For this reason, we have opted for a transgenic-based method that relies on a gene silencing process known as RNA interference. In this approach, a transgene engineered to silence or repress the expression of multiple gliadins concurrently is introduced into wheat through genetic transformation. To date, we have produced over 100 independent transgenic wheat lines expressing a gliadin-silencing transgene designed to eliminate the accumulation of gliadins and thereby the allergy-eliciting activity from their grains and flour. Thus, the purpose of this proposal is to seek support to perform the first level of analysis of these transgenic lines that we have already produced. This analysis entails an assessment of gliadin accumulation in the grain of transgenics and their progeny. In this study, we would like to assess the level of gliadin silencing that is achieved in a given line as well as determining which gliadins are affected. In subsequent research, that is beyond the scope of this proposal, we would like to assess the impact of reduced levels or lack of gliadins on end-use quality and its effect on allergenicity.