

## Production of a protein subunit vaccine for *Mannheimia haemolytica* in lettuce chloroplasts

The cattle industry worldwide is ravaged by bovine respiratory disease (BRD), a bacterial disease caused by *Mannheimia haemolytica*. We have designed a chimeric protein subunit vaccine against *M. haemolytica* based on recent evidence demonstrating the protective potential of antigens against a virulence factor, leukotoxin, in addition to a surface lipoprotein. Plant-based production of this protein vaccine provides a safe and inexpensive alternative to traditional production methods. Plant-based production also supports the use of an edible vaccine that will deliver antigens to pharyngeal tissues to provide local immunization against *M. haemolytica* prior to its progression into the lungs. Chloroplasts produce and accumulate bacterial proteins efficiently due to their prokaryotic translational machinery and internal environment. Bacterial proteins, such as those of *M. haemolytica* antigens, can therefore be produced to high levels within chloroplasts. In this project, *M. haemolytica* antigens will be produced in lettuce chloroplasts as a candidate edible vaccine for BRD. This endeavor necessitates the development and optimization of lettuce chloroplast transformation and regeneration of transplastomic lettuce plants, the analysis of gene expression and protein accumulation, and will thereby support future efforts to produce high-levels of recombinant proteins in transplastomic lettuce.