P3-201 “Determination of factors affecting high-level protein accumulation in transgenic maize seed”

Dr. Elizabeth E. Hood (PI), Xiuzhen Huang (Co-PI)

Abstract:

This project addresses one of the important goals within the P3 center—increasing protein bio-production capabilities. Transgenic crops are being developed to produce proteins used in industrial and pharmaceutical products. The hope is that this new generation of alternate products from plants will enable cleaner environmental solutions and more affordable medicine. For these applications, many of the basic molecular and cellular techniques that are useful to study input (agronomic) traits can be applied to boost protein accumulation for the most cost-effective production of output traits. The goal of making transgenic corn expressing an industrial protein is to recover the highest possible amounts of protein. The transgenic lines are routinely bred to elite inbred germplasm to improve the agronomic characteristics of the plants. In this breeding process, we observed that we could also increase the amount of recombinant protein. The progression is that in each generation the highest expressing ears showing agronomic promise are replanted in subsequent seasons. Only those ears showing improvement in the amount of extractable transgenic protein are selected for replanting. At each generation, approximately 10% of lines are replanted in the breeding program. Improvements in amount of recombinant protein of 10-100-fold can be recovered in 7 generations.

The complex phenomenon of protein increase could possibly be the result of the interaction of many hundreds of genes. We will determine an array of factors affecting increased protein accumulation and gene networks will be derived. The project will build a framework important for understanding gene expression phenomena. These experiments will help us gain an understanding of gene regulation important for protein accumulation in maize embryos that may be extrapolated to other seed systems. The information gained will be used in directed breeding programs for improved plant bio-production. Shorter path lengths to products from plants derived from biotechnological approaches will benefit the agricultural community and the public through accelerated product development using the technology derived from this project.