Gossypol, a naturally occurring terpenoid found in pigment glands located throughout the cotton plant, is an effective insect deterrent, but is also a cumulative toxin in simple-stomached animals. Plant biotechnology utilizing RNAi was used to create a plant that has no gossypol in the seed while retaining gossypol in all other plant tissues to prevent predation. Since cotton is drought and heat tolerant, it is well suited to serve as a source of both food and fiber as climate change puts other crops in jeopardy.

Agrobacterium transformation was used to insert into the cotton nuclear genome a construct containing a seed specific promoter driving an RNAi hairpin that suppresses delta-cadinene synthase. This enzyme plays a critical role early in building gossypol. This biotechnology-based proof of concept provides strong evidence that it is possible to produce a plant that retains its natural defense mechanism in the non-seed tissues while producing a drought and heat tolerant source of protein in the gossypol-free cottonseed.

The presence of Gossypol in cotton seed means all the protein produced by the cotton plant is relegated to ruminant feed and (in miniscule amounts) aquacultre. Recent research demonstrates 100% replacement of fishmeal with Ultra-Low Gossypol Cottonseed (ULGCS) in the feeds of several aquaculture species without a decrease in performance.

Each year about 10-11 million metric tons of cottonseed protein are produced worldwide. Without gossypol, this is enough protein to satisfy the daily, basic protein needs (50 grams/person) of more than 600 million people for one year. Food scientists have also created a wide range of food products from ULGCS, including hummus, plant-based dairy substitutes, a peanut butter alternative and protein fortified beverages. Elimination of gossypol in cottonseed could greatly improve utilization of this valuable protein resource for global food and fiber security as we move into an era of uncertain climate conditions.