IMPROVING COTTONSEED QUALITY FOR ANIMAL FEED

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Abstract

Cotton is cultivated for fiber production, and cottonseed is produced as a by-product of this process. Cottonseed provides a high quality protein and oil. However, cottonseed is currently underutilized due the presence of a toxic compound called gossypol. Gossypol and related compounds are also present in other parts of the plant. These compounds serve as a defense mechanism against diseases, insects, and rodents. Our work is aimed at selectively removing gossypol from seed to increase its nutritional value while maintaining gossypol and related compounds in other parts of the plant as a defense against pests and pathogens. Cottonseed quality for animal feed can also be improved by increasing (+)/(-)-gossypol ratio in cotton. It is the (-)-gossypol that is toxic to animals. For microbial pathogens, (+)- and (-)-gossypols are equally toxic. This approach also would not compromise cotton's defense against disease. We have identified and cloned a P450 gene involved in the biosynthesis of gossypol and related terpenoids. RNAi down regulation of this gene driven by 35S general plant promoter resulted in more than 90% reduction of total gossypol and heliocide pathway terpenoids in leaf and root tissues. We also identified a cotton (+)-gossypol-forming dirigent protein that governs the formation of (+)-gossypol in cotton. The cloning of this dirigent protein gene will enable us to genetically manipulate (+)-gossypol ratio in seed as well as providing molecular marker for maker assisted breeding of high (+)-gossypol ratio cotton. Our results show that high (+)-gossypol ratio trait of Moco cotton can be backcrossed into cotton cultivars, achieving as high as 96% (+)-gossypol ratio in seed and 99% (+)-gossypol ratio in flower petals.