

# Biotech

## In focus

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### Genetic Engineering and Pesticide Use: A False Equivalence Creates Confusion

This week's Biotech in Focus came from a paper written by Nyan Stillwell, a University of Hawaii at Manoa student who recently enrolled in TPSS 416 (Introduction to Social, Ethical, and Political Issues Associated with Biotechnology). Designed for non-majors, this class is offered by the Department of Tropical Plant and Soil Sciences in UH Manoa's College of Tropical Agriculture and Human Resources.



Genetically modified organisms (GMOs) have gained considerable public attention in recent years. Many negative claims have been leveled against the use of genetic engineering of agricultural crops, citing potential dangers to human health and the environment. Most of these assertions are not backed by evidence and are not supported by the scientific community. Nevertheless, the notoriety of these widespread claims makes it more difficult for members of the general public to make informed decisions about the uses, risks, and benefits of this technology.

One frequent argument against the use of GMOs in agriculture is that GM crops promote pesticide use. However, pesticides are used in all types of agriculture, including conventional and organic farming. The future of GM crops may rely on the understanding that pesticide use and genetic engineering are two distinctly separate tools available to today's farmers. We illustrate this point below comparing the use of chemical insecticides and genetic engineering.



# VS



Chemical pesticides, although often extremely effective when used correctly, can be harmful to human health and the environment if abused. Agriculture uses synthetic and natural pesticides to produce high-quality crops, but this can come at an environmental cost. Incorrect pesticide use can produce many negative impacts such as the unnecessary killing of beneficial insects and pesticide resistance. Exposure to Farm workers and residents in farming communities are most at risk for exposure to unsafe levels of pesticides. Pesticide residues on harvested products can pose a threat to consumers health if present in high amounts – the old adage applies “Dose makes the poison”. Because of possible negative impacts associated with pesticide use, scientists are working to develop alternatives to using harmful chemicals, including the development of low-risk pesticides, often of biological origin, and other biotechnological options.



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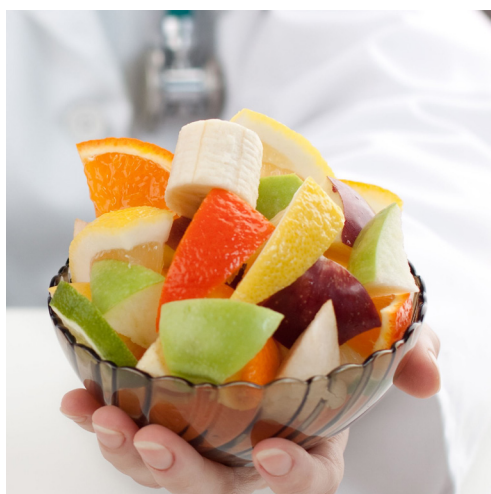
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# Highly Specific Resistance

One approach to lessen farmer reliance on chemical insecticides is genetic engineering of crops. For example, genetically engineered Bt cotton produces a protein from the bacterium *Bacillus thuringiensis* (the crop has the gene for this protein inserted into its genetic code), that provides highly specific resistance to a specific insect pests. Non-target impacts to beneficial insects on the crop are avoided. Bt cotton is grown using much less synthetic insecticide than is used on conventionally farmed non-GM cotton. This decreased reliance on synthetic insecticides promotes increased biodiversity, because unlike chemical insecticides, the pesticide protein produced within the cotton plant doesn't kill non-target insects that act as biological control agents on the crop. A reduction in pesticide usage also means that the potential for accidental exposure of people is reduced. Lastly, fewer pesticide applications can mean lower costs for spraying and for the pesticide and higher profits for farmers. Similar results have been found for Bt potatoes and sweet corn.



## Beneficial Traits



Genetic engineering can enhance crop plants to meet current agricultural challenges. The potential uses of GM crops reach far beyond the production of insecticidal proteins or tolerance to weed-killing chemicals. Crops can be engineered for many beneficial traits, including enhanced nutritional content, increased yield, improved tolerance to environmental stresses such as salt and heat, and resistance to damaging viral diseases

## Better Education

GM crops offer fewer risks and greater benefits than is widely known, and the use of pesticides is not limited to the farming of GM crops. To communicate this information more successfully will require better public education in the life sciences.



## Recognizing Potential



Genetic engineering might evoke less controversy if GM crops were recognized as a potential means to limit environmental damage, such as Bt cotton that diminishes the need for chemical insecticides. This technology can be a valuable tool for food production, pest management, and environmental protection.