Cooperative Extension Service
Biotechnology Outreach Program
College of Tropical Agriculture and Human Resources
University of Hawai'i at Manoa

Biotech In focus

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The first generation of GE farming:

Thus far, we've covered 10,000 years of farming history. Starting with seed selection, we've filled our farmer's tool kit with an expanding list of ways to grow high-yielding, good-tasting crops and protect them from pests and diseases.

2 TRAITS

3 CROPS

169 MILLION ACRES

classical breeding:
using plant reproduction to improve crops by moving genes among varieties (DNA recipes) for helpful traits

hybrid varieties:
especially of corn that greatly increased yield and disease resistance

integrated pest management:
in which farming practices and the natural enemies of pests can minimize the need for pesticides

high-tech breeding:
combining classical breeding with 20th century lab methods (see Issue 4)

the "**green revolution**":
(1940 to 1970) led to release of high yielding short wheat and rice varieties that did not fall over when mature, coupled with improved irrigation, use of pesticides and fertilizers. Reduced famine in parts of Asia and Africa

genetic engineering, the newest strategy, which uses technology to add genes to crop plants, typically genes for useful traits from species the crop of interest can't breed with

Genetically engineered (GE) crops have been grown for sale in the United States since 1996. Less than two decades since being introduced, their popularity with corn, soybean, and cotton farmers has skyrocketed. In 2013, GE crops were planted on 9 out of every 10 U.S. acres growing corn or cotton, and 93 percent of the acres in soybean. Added together, these GE varieties account for about half of U.S. crop land!

Ania Wieczorek, PhD
Associate Professor
Department of Tropical Plant and Soil Sciences
College of Tropical Agriculture and Human Resources
University of Hawai'i at Manoa
Honolulu, HI 96822
ania@hawaii.edu

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Two Popular Traits

Two types of traits are present in these very popular GE commodity crops: (1) herbicide tolerance, which lets the crop plant survive undamaged when it's sprayed with a particular weed killer, and (2) Bt, bacterial proteins that are poisonous to some insects but are safe for other organisms. Almost all GE soybeans are herbicide-tolerant, whereas GE corn and cotton varieties may carry genes for herbicide tolerance, Bt, or both. Most growers report that their reason for choosing GE crops is to increase their yields, for greater management flexibility and to reduce inputs like insecticides.

Save Time & Soil

Herbicide tolerance lets growers spray for weeds after planting the crop rather than before. This saves time and can help conserve soil because tillage is reduced.

Bt Protein

Bt crops make their own insecticide which adds to the natural pesticides already found in all plants. This technology allows farmers to greatly reduce spraying synthetic chemicals. The genes for Bt proteins come from the bacterium Bacillus thuringiensis, which has been used as a crop spray for almost a century by organic and conventional farmers.

Other GE Crops

While corn, soybean, and cotton are the dominant GE crops, other GE crops are grown as well. Most are herbicide-tolerant varieties of canola, sugar beet, and alfalfa, but two crops have been engineered to resist viruses.

Of the two virus-resistant crops, GE squash isn't widely grown. However, the other virus-resistant GE crop—papaya—is probably familiar to many Hawaii residents. The papaya ringspot virus began attacking papaya farms in Puna in 1992. Since 1998, Hawaii farmers have grown GE papaya varieties that resist the virus. In recent years, more than three-quarters of Hawaii's papaya crop has been GE. These engineered plants make a ringspot virus protein that triggers plant defenses. The protein, like the virus, is considered safe to eat. People who eat naturally virus infected papaya eat much more of this protein. Who makes these safety determinations? That's the subject for our next bulletin.

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