



'UH Rainbow' Papaya

A High-Quality Hybrid with Genetically Engineered Disease Resistance

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'UH Rainbow' papaya is a new hybrid variety developed by the College of Tropical Agriculture and Human Resources of the University of Hawaii at Manoa. 'UH Rainbow' combines the superior quality typical of Hawaii's "solo" papayas with excellent resistance to a devastating plant virus disease—papaya ringspot virus (PRSV). This combination of traits was accomplished through genetic engineering, one of the latest advances in agricultural biotechnology (see page 2, over).

'UH Rainbow' is an F₁ (first-generation) hybrid produced by crossing Hawaii's standard export variety, 'Kapoho', with the first genetically engineered papaya with resistance to PRSV, 'UH SunUp'. The resulting hybrid is an excellent source of vitamins A and C and is highly productive.



About 'UH Rainbow' papaya

Appearance

Shape	pear-shaped (with short neck) to elliptical
Weight	range 1–2 lb, average 1½ lb (650 g)
Flesh color	yellow-orange
Flesh thickness	1 inch

Taste panel evaluation

Taste	sweet (12–16% sugar) and pleasant
Texture	uniform and juicy
Aroma	mild

Nutritional value

	Percent of daily value*
Vitamin A (<i>trans</i> beta-carotene)	41 %
Vitamin C	188 %

*One serving = ½ papaya (220 g edible portion)

Ripening

The fruit is ready to eat when it is 70–90% yellow and yields slightly when squeezed.

Other characteristics

The seeds separate easily and cleanly from the flesh. The plants are highly resistant to papaya ringspot virus, a disease that has repeatedly threatened to destroy papaya production in Hawaii. Because 'UH Rainbow' is a hybrid variety, plants grown from seeds in the fruit will not "breed true," and they may not be resistant to PRSV. New hybrid seed must be obtained and planted each generation.

Availability

Packets of 'UH Rainbow' and 'UH SunUp' seeds are available to home gardeners from CTAHR's Agricultural Diagnostic Service Center. Terms of a license agreement require that seed purchasers first attend a 1-hour orientation course, offered periodically. For information, contact Richard Sakuoka at (808) 956-7890 or 956-6706 (phone), (808) 956-3894 (fax), or e-mail <rsakuoka@hawaii.edu>.

Questions and answers about genetic engineering

What is genetic engineering?

Genetic engineering is a molecular-biology technology that allows the transfer of a genetic trait, such as resistance to a virus disease, from one kind of organism to another. In the case of the genetically engineered papayas, a gene that prevents infection by papaya ringspot virus (PRSV) was found in the virus itself. It was transferred to a papaya, creating a PRSV-resistant variety.

Why haven't I seen other genetically engineered fruits and vegetables in the market?

Genetic engineering is a new technology, and 'UH Rainbow' and 'UH SunUp' papayas are the first genetically engineered fruits to be commercialized in the United States. But more will be seen in markets as new varieties are approved.

Is genetic engineering necessary?

In some cases, yes. Some problems, such as overcoming PRSV, cannot be solved without it. In papayas, there are no naturally occurring genes for effective resistance to PRSV, so plant breeders have nothing to work with to improve the crop. Without the genetically engineered form of PRSV resistance, the papaya industry in Hawaii would be destroyed by the virus, resulting in lost livelihoods for growers and higher prices for consumers.

Is genetic engineering risky?

Genetic engineering is a powerful tool for manipulating biological organisms, and consequently it has great potential for beneficial use. However, as with any powerful tool, care is required to ensure that the new technology is applied responsibly and appropriately. There is a need for strict monitoring of the objectives and methods of genetic engineering. We need to be assured that genetically engineered products serve the public good, not just the agenda of the producer.

How can I be assured that genetically engineered food products are safe?

Development of genetically engineered crops and foods is monitored by three federal regulatory agencies—the U.S. Department of Agriculture, the Environmental Protection Agency, and the Food and Drug Administration. All three agencies examined the development of 'UH Rainbow' and 'UH SunUp' from the perspectives of their mandated areas of concern and approved them as safe.

Can I be infected with the PRSV virus by eating genetically engineered papayas?

Definitely not. In the first place, genetically engineered 'UH Rainbow' and 'UH SunUp' contain only a fraction of the virus's total genetic information, not the complete virus. And people routinely consume many plant products infected with plant viruses, without ill effect. This is because plant viruses like PRSV cannot infect humans at all. There is no danger of becoming infected with PRSV from eating the fruits of genetically engineered papaya varieties.

Does genetic engineering make 'UH Rainbow' and 'UH SunUp' better than other papayas?

Yes! 'UH Rainbow' and 'UH SunUp' are high-quality solo-type papayas, very similar, respectively, to the yellow-fleshed 'Kapoho' and the red-fleshed 'Sunrise', which have been the standard varieties in Hawaii and around the world for years. But those varieties are susceptible to papaya ringspot virus, which recently devastated a large part of Hawaii's 'Kapoho' acreage. Genetic engineering has made 'UH Rainbow' and 'UH SunUp' resistant to PRSV, thereby enabling local growers to continue to provide this delicious, nutritious product of Hawaii at affordable prices.