



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

# Market Testing of Labeled and Unlabeled GMO Papaya Fruits in Honolulu Chain Stores

Sabry Shehata

According to the Statistics of Hawaiian Agriculture, in 2003 the value for most Hawaiian fruit sold was higher than it was a year earlier, totaling \$129.7 million, three percent more than in 2002. Fresh papaya production totaled 40.8 million pounds in 2003, four percent below the previous year, the second consecutive year of decline. Fresh fruit accounted for virtually all production, 96 percent of the state's total; export shipments were responsible for 46 percent of fresh fruit utilization. Growers planted primarily Rainbow and Kapoho varieties of papaya, and Hawaii's August 2002 total papaya acreage was 2,145 acres, 21 percent less than at the same time one year earlier. Bearing (harvested) acres across the state were 24 percent lower in 2003 than in 2002.

Papayas in Hawaii are chiefly grown from genetically engineered papaya seed that is resistant to papaya ringspot virus. Japan is a major importer of Hawaiian papaya but it will not accept GM foods. No federal guidelines currently specify labeling of GM produce or products containing GM ingredients for U.S. marketing channels; growers and distributors in the United States are not required to label genetically engineered food in grocery stores. Only organic foods are required to be free of GM material, although "GM free" labels may be used by a retailer or wholesaler as part of their individual marketing strategy.

U.S. labeling requirements, if imposed, may affect exports of U.S. fruit because international markets may demand that GM products be labeled or may not accept them at all. Hawaii has been steadily losing market share in the Japanese papaya market to the Philippines since 1995. In 2002, the Philippines had 56 percent of the market, while Hawaii had 43 percent. The competitive disadvantage of Hawaii-grown papayas may stem from Hawaii's distance from Japan, the higher relative price of Hawaii papayas and a limited supply of non-GM

papayas from Hawaii. Papayas from the Philippines are roughly half the price of Hawaiian papayas. Furthermore, the distance between the two countries is shorter, resulting in fresher, less-damaged fruit.

Organizations such as GMO-Free Hawaii wish to move Hawaiian agriculture away from genetically engineered crops and toward locally-based sustainable agriculture. They have members on each of the major Hawaiian Islands.

A survey is being conducted to determine the consumer's attitude toward GMO fruits in Hawaii. The results will be used to assess the present state of consumer knowledge about such fruits and to assist in the design of appropriate policy recommendations for decision makers in Hawaii. A similar survey will be conducted in Japan.

This research determines how Hawaii consumers react to the sale of genetically modified fruits. It will be used as a guide to penetrate the Japanese market.

## Review of the Literature

Producers, distributors and grocers present consumers with a variety of label product claims in an effort to attract greater sales or higher prices for their fresh produce. In an attempt to disentangle the value that consumers place on two of these claims, Constanigro et al. (2010) presented shoppers with a choice of organically and locally grown produce. Using primary data from a choice experiment conducted in a grocery store that had conducted co-promotional efforts with the Colorado Proud program, they found that the value of "local" claims trumps that of "organic" in apples. (Constanigro, 2010)

James, Rickard, and Rossman (2009) found similar results. Consumers were asked to choose an applesauce product from a list of products differentiated by price and four other attributes. The products were differentiated by labels that described fat content, nutritional content, and whether the product was grown organically and/or locally. They found that consumers were willing to pay more for

---

Shehata is Professor, Department of Agricultural Economics, University of Hawaii at Hilo.

locally grown applesauce compared to applesauce that was labeled organic or low-fat and low-sugar. Furthermore, the analysis incorporated the effects of consumer characteristics on the demand for applesauce attributes and found evidence that increased knowledge of agriculture decreases the willingness to pay for organically and locally grown applesauce. (James, Rickard, and Rossman 2009)

Novotorova and Mazzocco (2008) used a conjoint analysis methodology in an online survey to measure consumers' preferences for apple attributes such as place of production, method of production, and price. The results of the analysis indicated that consumers are willing to make trade-offs between the studied attributes. Place-oriented consumers may, for example, be willing to pay 60 percent to 70 percent premiums for locally grown apples. Novotorova and Mazzocco suggest that the high consumer preferences for locally grown products, combined with environmental benefits transferred through genetic modification, provide an opportunity for producers to capture and build their markets. (Novotorova and Mazzocco 2008)

In a New Zealand study, where the genetically modified issue has been highly politicized, Knight, Mather, and Holdsworth (2005a) state that much of the resistance toward genetically modified foods appears to stem from public perceptions that they offer no consumer benefits. In order to test whether clearly defined consumer benefits would change behavior, the researchers conducted a purchasing experiment. Cherries labeled as spray-free genetically modified, organic, or conventional were offered for sale in a roadside stall, with price levels manipulated to test price sensitivity of the different options. Approximately 27 percent of consumers proved willing to purchase genetically modified labeled cherries when all three types were priced at the prevailing market price, and this market share increased to 60 percent when the price was discounted by 15 percent and organic was priced at a 15 percent premium. (Knight, Mather, and Holdsworth 2005a)

In a second paper from the same experiment, Knight, Mather, and Holdsworth (2005b) examined consumer willingness to buy genetically modified (GM) foods with a price advantage and other benefits, compared with organic and ordinary types of foods. The importance of this increases as the volume and range of GM foods grown and

distributed globally increases. As before, customers chose among three categories of fruit (organic, GM, and ordinary) with experimentally designed levels of price in a roadside stall in a fruit-growing region of New Zealand. Buyers were advised, after choosing, that all the fruit was standard produce, and the experiment was revealed. The authors conclude that when the GM label is combined with a typical functional food benefit, GM fruit can indeed achieve significant market share among organic and ordinary fruit, even in a nation where the GM issue has been highly controversial; GM fruit can gain a sustainable competitive advantage from any price reduction associated with production cost savings; and market shares of organic fruit are least sensitive to pricing and the introduction of GM fruit. (Knight, Mather, and Holdsworth 2005b)

### **Methodology**

In order to test consumer response to GM fruit, grocery stores on Oahu were selected to participate in the study. The Times Super Market chain of groceries was willing to participate in the research. Six stores were selected for the study based on location (two stores each in low-, middle-, and high-income neighborhoods). In all locations, the labels "Hawaiian Grown GMO Papayas" were placed onto the fruits and a scan number was designated. Non-labeled papayas had a different scan number. The two fruits, otherwise identical, were displayed and marketed next to each other in the stores' produce departments. The data were collected daily in the first portion of the study, and weekly in the second portion. The experiment began in May and continued through June. The sale price for unlabeled papaya was fixed at \$1.49 per pound.

In the first portion of the experiment, the fruits were placed in three of the stores and the price for both labeled and unlabeled fruit was set at \$1.49. Later, the price for labeled papayas was increased to \$1.69 per pound and for unlabeled to \$1.59 per pound.

In the second portion of the experiment, we repeated the test using a more explicit label, spelling out "Hawaiian Grown Papaya—Genetically Modified Organism." The test period was six weeks, with data collected weekly. The price for the fruits was fixed at \$1.49 per pound for the duration of the experiment.

## Results and Analysis

Table 1 presents the sales of labeled and unlabeled papaya fruits at two different price points during the first portion of the experiment. The price elasticity of demand (PEoD) for unlabeled fruit is much higher than for labeled papayas, indicating that Honolulu shoppers are far more sensitive to changes in price for unlabeled papayas than for the labeled fruits.

Table 2 presents the results of the second phase of the experiment. In this case, the label was more explicit, spelling out “Hawaiian Grown Papaya—Genetically Modified Organism.” During the three-month test period over 15,500 papayas were sold in the three stores. Of these, 65 percent were the labeled fruits. Average monthly sales of labeled papaya per store amounted to 3356 lbs per store compared to just 1811 lbs for the unlabeled fruits. These results are different at a significance level of 0.02. One can conclude that the label has a positive impact on the sales of the fruit.

## Discussion and Conclusion

We can generalize from these results that the labeling of papaya fruits increases their sales in Hawaiian groceries. Explicitly identifying the fruit as genetically modified not only does not increase the market risk, it increases the sales of the product. Furthermore, the elasticity of demand for unlabeled papaya has a value of 2.83, almost twice that of labeled papaya, with a value of 1.49. This indicates that Honolulu consumers are substantially more sensitive to the price of unlabeled papaya than of the labeled counterparts.

These results could be attributed to a consumer perception that a labeled product implies a better quality item, a desire by the consumer to sample GMO fruits, or a general lack of knowledge regarding the terms “GMO” and “Genetically Modified Organism.” Whatever the reason, the results were significant at the 0.002 level. The greater demand for labeled papaya, coupled with an equally significant lesser sensitivity to price changes in the labeled

**Table 1. Price Elasticity of Demand for Labeled and Unlabeled Papaya. Label Indicates “Hawaiian Grown GMO Papaya.”**

	Fruit sold (lbs) @ \$1.49/lb	Fruit sold (lbs) @ higher price	Increase in price (\$/lb)	Price elasticity of demand
Labeled fruit	2759	2285	0.20	1.49
Unlabeled fruit	1053	864	0.10	2.96

**Table 2. Monthly Sales of Labeled and Unlabeled Papaya. Label Indicates “Hawaiian Grown Papaya, Genetically Modified Organism” (lbs).**

	Labeled fruit sold	Unlabeled fruit sold
Store #1	3609	1640
Store #2	4246	1626
Store #3	2215	2167

papaya, suggests that Honolulu consumers are not daunted by a product being labeled as genetically modified.

The benefits of labeling exceed the cost of labeling (lost sales from limited number of consumers who do not want to eat GMO food, label production and application costs, etc.). Based on these findings, it would seem that labeling papaya in Hawaii is positively indicated, but further research is needed to determine the impact of labeling on GMO papaya sales on the U.S. mainland and in Japan.

These results are relevant only to those genetically modified products which do not change their form and are not used as ingredients in other products, such as tomatoes, apples, fish, etc.

The cost of labeling will become a production/marketing cost but likely will not result in a significant price increase to consumers. Any firm or industry marketing GM food/fruit would likely benefit from providing information to supplement a label. It is expected that consumers in the Japanese market will be wary of GM papaya. While this research suggests that labeling of the papaya is likely warranted, this may not be sufficient information for consumers to fully understand the benefits and costs associated with consuming GM papaya. Therefore an educational effort, based on credible scientific information, is perhaps necessary for papaya or any genetically engineered fruit if producers plan to develop and maintain strong local and export markets.

## References

- Constanigro, M., S. Kroll, D. Thilmany McFadden, and G. Nurse. 2010. "Local and Organic: Substitutes or Complements? An In-Store Evaluation of Labels for Apples." Selected paper, Agricultural & Applied Economics Association Meeting, Denver. July.
- James, J. S., B. J. Rickard, and W. J. Rossman. 2009. "Product Differentiation and Market Segmentation in Applesauce: Using a Choice Experiment to Assess the Value of Organic, Local and Nutrition Attributes." Working papers, Cornell Dept of Applied Economics and Management.
- Novotorova, N. K. and M. A. Mazzocco. 2008. "Consumer Preferences and Trade-Offs for Locally Grown and Genetically Modified Apples: A Conjoint Analysis Approach." *International Food and Agribusiness Management Review* 11(4).
- Knight, J. G., D. W. Mather, and D. K. Holdsworth. 2005a. "Consumer Benefits and Acceptance of Genetically Modified Food." *Journal of Public Affairs* 5(3-4).
- Knight, J. G., D. W. Mather, and D. K. Holdsworth. 2005b. "Pricing Differentials for Organic, Ordinary and Genetically Modified Food." *Journal of Product and Brand Management* 14(6).