

Organic fruits and vegetables work harder for their nutrients Produce has been losing vitamins and minerals over the past half-century

Deborah K. Rich, Special to The Chronicle
Saturday, March 25, 2006

The fruits and vegetables that our parents ate when they were growing up were more nutritious than the ones we'll serve our children tonight. On average, the produce we grow in the United States has lower levels of several vitamins and minerals today than it did 50 to 60 years ago. By growing or buying and eating organic produce, however, we can make up much of the difference. Organically grown fruits and vegetables are proving to have higher levels of antioxidants, vitamins and minerals than their conventionally grown counterparts.

Donald R. Davis, a research associate with the Biochemical Institute at the University of Texas, Austin, recently analyzed data gathered by the USDA in 1950 and 1999 on the nutrient content of 43 fruit and vegetable crops. He found that six out of 13 nutrients had declined in these crops over the 50-year period (the seven other nutrients showed no significant, reliable changes). Three minerals, phosphorous, iron and calcium, declined between 9 percent and 16 percent. Protein declined 6 percent. Riboflavin declined 38 percent and ascorbic acid (a precursor of vitamin C) declined 15 percent.

A study of the mineral content of fruits and vegetables grown in Britain between 1930 and 1980 shows similar decreases in nutrient density. The British study found significantly lower levels of calcium, magnesium, copper and sodium in vegetables, and of magnesium, iron, copper and potassium in fruit. The report concludes that the declines indicate "that a nutritional problem associated with the quality of food has developed over those 50 years."

The decline in our produce's nutritional value corresponds to the period of increasing industrialization of our farming systems. As we have substituted chemical fertilizers, pesticides and monoculture farming for the natural cycling of nutrients and on-farm biodiversity, we have lessened the nutritional value of our produce. Integrated well-established organic farming systems can counter the decline.

Good science comparing the nutritional value of organic and conventional foods is accumulating rapidly. It isn't uncommon for researchers to find that the higher nutrient levels in organic produce completely offset the declines Davis found in conventional produce. "What all our data shows," says Charles Benbrook, chief scientist at the Organic Center and a former executive director of the Board on Agriculture of the National Academy of Sciences, "is that whenever there's been a valid comparison between conventional and organic, organic is virtually never lower than conventional and, in a significant number of cases, it's higher. Sometimes it's significantly higher in several important nutrients."

For example, Virginia Worthington, a clinical nutritionist who earned her doctorate in nutrition at Johns Hopkins, published a review in 2001 of 41 studies comparing the nutritional value of organic and conventional produce. After tallying the data across all the studies, Worthington concluded that organic produce had on average 27 percent more vitamin C, 21.1 percent more iron, 29.3 percent more magnesium and 13.6 percent more phosphorous than conventional produce.

Benbrook released a review in 2005 of the research comparing antioxidant levels in conventional and organic foods. In humans, antioxidants reduce damage to cells and DNA from free radicals (molecules generated by metabolic processes within the body), and thereby promote cardiovascular health, inhibit the reproduction of cancerous cells, slow the aging process in the brain and nervous systems, and lessen the risk and/or severity of Alzheimer's, Parkinson's and Huntington's diseases. Benbrook found that in 85 percent of the comparable data points, produce from organic farms had higher levels of antioxidants than did produce from conventional farms. On average, antioxidant levels in organic produce were 30 percent higher.

Earlier this year, a Swedish team of scientists demonstrated that extracts from organically grown strawberries slowed the proliferation of colon and breast cancer cells to a significantly greater degree than extracts from conventional strawberries did. The levels of all the antioxidants analyzed by the team were higher in the organic strawberries than in the conventional.

"As someone that has been involved with science and science policy for my whole life," says Benbrook, "I think the scientific case has been made for organic produce. The case has been made firmly enough so that it is appropriate and, indeed, irresponsible at this point not to tell consumers straight up that choosing organic fruits and vegetables probably delivers nutritional benefits because of the higher levels of antioxidants and vitamins and minerals."

The decline in nutrients

Our push for higher yields per acre and cheaper food is largely to blame for the decline in nutrient levels in conventional produce. With irrigation and fertilization we can get more pounds per acre, but often not without sacrificing nutrients per pound produced. This "dilution effect" on nutrient density was widely observed by agricultural scientists even 20 to 30 years ago. The use of hybrids selected for high yields has probably compounded the trade-off between yield and nutrients. Davis writes, "Modern crops that grow larger and faster are not necessarily able to acquire nutrients at the same, faster rate, whether by synthesis or by acquisition from the soil."

In addition to pushing a plant to grow big fast, heavy fertilization can interfere with a plant's ability to synthesize vitamin C. A plant will increase protein production and reduce carbohydrate production when it absorbs an abundance of nitrogen. "Because vitamin C is made from carbohydrates, the synthesis of vitamin C is reduced," writes Worthington.

Use of potassium fertilizers (potassium is the "K" in N-P-K fertilizers) can reduce the phosphorous content of some plants. For the plant to absorb phosphorous, it must have adequate amounts of magnesium. But when potassium is added to soil, plants absorb less magnesium, and, indirectly, less phosphorus as well.

Organic farmers do not use synthetic formulations of fertilizers, and this restriction is part of the reason organic produce has relatively higher nutrient values. Organic farmers feed their crops only indirectly. Instead of plying plants with nitrogen, phosphorous and potassium in readily dissolved and absorbed powders and solutions, they fertilize their crops by adding organic matter to the soil in the form of composts, cover crops and manures. The organic matter feeds microorganisms in the soil that, in the process of eating and living and dying, recycle the nutrients embedded in the organic matter. The microbes slowly release not only nitrogen,

phosphorous and potassium but also a host of other nutrients in ratios difficult to replicate with synthetic fertilizers.

The large populations of microorganisms that typically inhabit organically managed fields also produce substances that combine with minerals in the soil and make them more available to plants, a function that can be especially important for iron absorption. Iron is usually present in soil, but it is often in an unavailable form.

The relatively larger root-balls of organic plants are another reason organically grown plants can absorb a wider variety of nutrients than chemically fertilized plants can. Because organic plants don't have macronutrients spoon-fed to them, they grow larger root systems out of necessity. Roots on organic plants have to range farther to access sufficient nitrogen, phosphorous and potassium. In the process, they come into contact with more trace minerals and micronutrients than the smaller root-balls of conventional plants do. "When plants are growing, they sense how big a root system they have to produce to draw from the soil the nutrients and moisture they need to grow and reach maturity and reproduce," says Benbrook. "On a conventional farm where there are high levels of fertilizer nutrients in the soil, along with lots of water, there is little incentive for roots to penetrate far."

Making healthful choices

The role that antioxidants play in plant health probably also contributes to the higher antioxidant levels found in organic produce. Many antioxidants help a plant resist diseases, deter pests and recover from insect damage. Because organically grown plants do not "benefit" from the protection of pesticides, they must be able to muster their own defenses and therefore produce high levels of antioxidants.

By providing plants with more balanced nutrition and by triggering production of higher levels of antioxidants, organic farming systems yield fruits and vegetables that are, on average, more nutrient dense than conventional produce. We can maximize the nutritional benefits of eating fruits and vegetables by choosing organic.

"For the average consumer that's looking for a way to tilt their odds in favor of healthy development and graceful aging for themselves and for their families, the single most important thing they can do is eat more fruits and vegetables and less added fat, sugar and highly processed foods," says Benbrook. "The second most important thing for them to do is to seek out organic fruits and vegetables known to be high in vitamins and antioxidants."

Foods rated "very high" and "high" in antioxidants

VERY HIGH

Blueberry, wild; artichoke, cooked; black plums; broccoli raab; blackberry; strawberry; blueberry, cultivated; cabbage, red; raspberry; apple ('Red Delicious'); apple ('Granny Smith'); sweet cherry; bean, red kidney; navel orange; prune; bean, pinto; pear ('Red Anjou'); grape, red; potato, russet; raisin

HIGH

Asparagus, raw; lettuce, red leaf; asparagus, cooked; beet; grapefruit, red; peach; pepper, yellow; tangerine; onion, yellow, cooked; apricot; grape, green; pineapple; potato, white; black-eyed pea; almond

Source: The Organic Center

Resources

- Donald R. Davis: "Trade-Offs in Agriculture and Nutrition," Food Technology, March 2005, Vol. 59, No. 3. A graph that illustrates the nutrient declines mentioned in the article is titled, "Trends in 43 Garden Crops USDA Data, 1950-1999" and can be found at www.organic-center.org/reportfiles/Davis_ppt.pdf.
- Virginia Worthington: "Nutritional Quality of Organic Versus Conventional Fruits, Vegetables and Grains." The Journal of Alternative and Complementary Medicine, Vol. 7, No 2, 2001.
- Anne-Marie Mayer: "Historical Changes in the Mineral Content of Fruits and Vegetables," British Food Journal, 99/6, 1997.
- The Swedish study, conducted by Marie E. Olsson, C. Staffan Andersson, Stina Oredsson, Rakel H. Berglund and Karl-Erik Gustavsson, is "Antioxidant Levels and Inhibition of Cancer Cell Proliferation in Vitro by Extracts From Organically and Conventionally Cultivated Strawberries," Journal of Agricultural and Food Chemistry, American Chemical Society, published on the Web, Jan. 21, 2006.
- The Organic Center, www.organic-center.org.
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This article appeared on page F - 5 of the San Francisco Chronicle

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