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State of Science Review: Taste of Organic Food



Do Organic Fruits and Vegetables Taste Better than Conventional Fruits and Vegetables?

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I. FOCUS STATEMENT



This State of the Science Review attempts to answer the question “Do organic fruits and vegetables taste better than conventional fruits and vegetables?”. There are several reasons why this question should be addressed.

First, 43% of consumers of organic food give “better taste” as a major reason for purchasing organic fruits and vegetables (MORI Poll 2001, cited by Heaton (Heaton, 2001)). It is important to know if the consumer conviction of “better taste” is due solely to the “halo effect”¹ of the organic label, and, if not, what accounts for the often-cited claim that organic produce tastes better.

Second, the levels of some phenolic compounds are known to be higher in organic fruits and vegetables (Benbrook, 2005). Plants create phenolic compounds for many reasons, but a major reason is to make plant tissues less attractive to herbivores, insects, and other predators. Some phenolic compounds actually taste bad (Drewnowski and Gomez-Carneros, 2000; Lesschaeve and Noble, 2005). The bitter taste and the tactile sensation of astringency in tea, cider, red wine, and chocolate are caused primarily by the flavonoid phenolics, including flavanols and flavonols (Lesschaeve and Noble, 2005). These phenolic compounds, like those in red grapes, are often responsible for the unique flavor of certain fruits. Accordingly, it is important to sort out if higher levels of phenolic compounds affect the taste of organic fruits and vegetables when compared to conventionally grown produce.

ORGANOLEPTIC

What Is “Organoleptic Quality?”

The dictionary defines “organoleptic” as “of or pertaining to the sensory properties of a particular food or chemical.” Organoleptic quality includes the typical sensory properties of a food: its taste, appearance and color, aroma, size and firmness, and even sound (e.g., the “snap” or “crack” when biting into a crisp apple). But organoleptic measures also include mouth feel and any other sensations related to eating a food.

The term organoleptic quality is used broadly in this document to include storage properties (“storability”), since many fruits and vegetables are stored for various periods of time to enable “non-seasonal” retail availability. Clearly, produce that stores well will be more appealing to consumers than fruit with visible blemishes, soft spots, or lack of flavor. Organic cultivation practices can influence storability and thus alter the organoleptic qualities of produce at the point of sale and consumption.



¹ “Halo effect” is the term used to describe cognitive bias that arises when information about one quality attribute of a product serves to influence and bias the judgment of its other qualities.

Third, many sellers, distributors, and promoters of organic foods claim that organic foods taste better. When such assertions are included in advertising and promotional literature, they must comply with federal rules governing marketing claims and must be backed up by credible scientific evidence. As the organic industry moves toward more direct claims regarding comparative taste in advertising and product labeling, it will be essential to support such claims with a strong body of evidence from carefully designed and controlled experiments. Lacking such evidence, the industry will be vulnerable to critical investigations by government agencies and possible erosion in consumer confidence.

There actually are several ways that this “simple” question – Do organic fruits and vegetables taste better than conventional produce? – can be interpreted and answered.

- Does a fruit or vegetable labeled “organic” receive higher organoleptic scores than the “same” fruit or vegetable not so labeled?
- Do fruits and vegetables collected from organic markets receive higher organoleptic scores than the “same” fruits and vegetables collected from conventional grocery stores?
- Do fruits and vegetables grown organically in a certain geographical and climatic area have higher organoleptic scores than the “same” fruits and vegetables grown conventionally in the same geographical and climatic area?
- Do fruits and vegetables grown by different cultural practices show distinctive differences in organoleptic quality and, if so, to which specific factors and cultural practices can these differences be attributed?

While seemingly similar, these questions are in fact quite different. The purpose of this State of the Science Review is to help readers interpret the published literature on the comparative organoleptic characteristics of organic foods in the context of the questions posed above.



V. CONCLUSIONS

Several conclusions can be drawn from published research on the organoleptic quality of organic food compared to conventional food:

- Most studies report no consistent or significant differences in taste and organoleptic quality.
- Of those studies reporting differences, the vast majority conclude that organic produce is superior or preferred when compared to conventional produce, or produce grown using "integrated" production systems.
- It is extremely rare that the taste of organically grown fruits and vegetables is found to be poorer than that of fruits and vegetables grown conventionally or with integrated techniques.

Organic apples especially are usually preferred over conventional or integrated apples; this finding has been replicated in closely controlled comparisons, which increases our confidence that organic apples may truly taste better than conventional apples. In addition, several studies have reported that organic produce stores better and has longer shelf life than conventional produce. This finding appears to be linked to the lower level of nitrate that is usually found in organic produce.

Future Challenges that Require Further Research

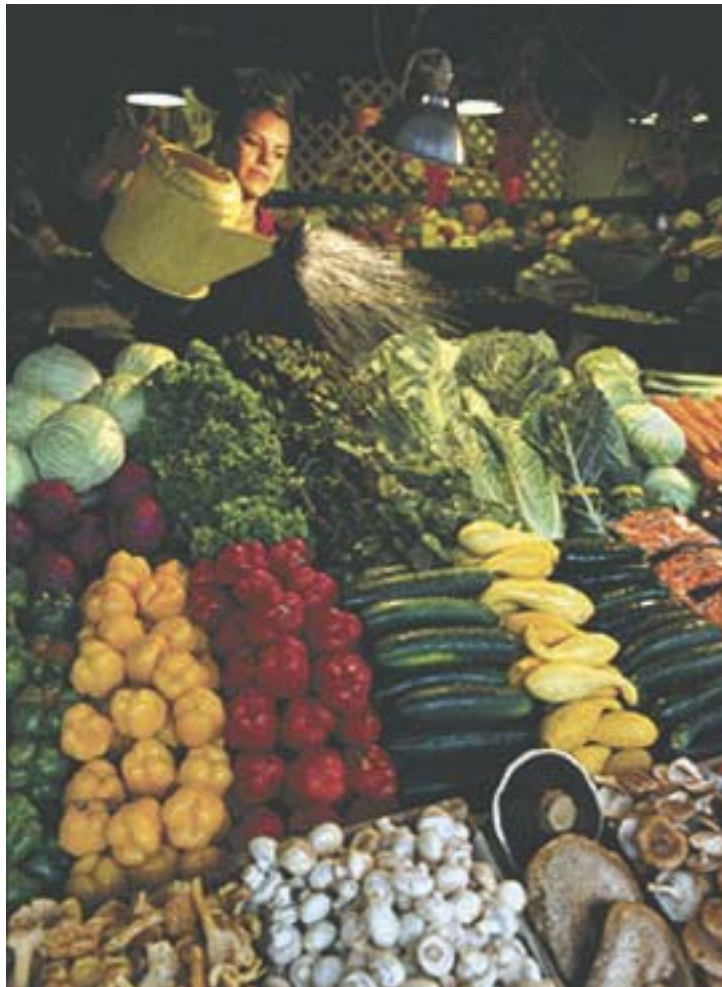
Many studies have found that lower yields, better taste, more Vitamin C, and higher antioxidant levels in organic fruits and vegetables are correlated with lower levels of readily available nitrogen. A major focus on many organic farms is increasing the supply of nitrogen for crops,

in order to narrow the differences in yields between conventional and organic production systems. Will success in increasing the nitrogen available to plants on organic farms erase the quality advantages of organic produce? Stated differently, are lower yields nature's "quid pro quo" for the quality advantages of organic produce?

Organic apples generally are firmer and have superior storage properties. Organic potatoes generally contain more ascorbic acid (Vitamin C) (Hajslova et al., 2005). Both of these phenomena are associated with lower plant tissue nitrate levels and correspondingly slower growth rates and greater physiological maturity at harvest. This highlights a major difference between organic management and conventional management: the nitrogen economy of the plant. Nitrogen

economy has both a quantitative aspect – the amount of nitrogen applied – and a qualitative aspect – the source(s) of that nitrogen.

Organic cultivation frequently is a low-nitrogen input system. This probably is responsible for the generally lower yields of organically cultivated produce, even by technically capable organic farm managers. For example, organic citrus cultivation is expanding in Corsica, but yields can be 50% less than under traditional cultivation. Berghman et al. found that the low yields were related to inadequate



nitrogen assimilation by roots from plant compost (Berghman et al., 1999). To achieve satisfactory yields it was necessary to use two complementary nitrogen-source products: seabird guano rich in soluble nitrogen and castor oil cake rich in organic carbon.

These workers established that providing more nitrogen, and more timely applications of nitrogen, increased total leaf nitrogen levels and yields of organic citrus trees to the normal range observed on conventional farms. It would have been very useful to determine if the tissue nitrate level in the organic fruit increased to the same level as in conventional fruit.

It is established that high levels of nitrogen fertilizer applied in conventional cultivation of apples can have negative effects on fruit color and storage quality (Saitoh, 1995). Increasing the application rates of nitrogen by using more composted manure in organic cultivation has been shown to better meet the nitrogen demands of organic corn and tomato crops, and also to increase yields (Poudel et al., 2002). Unfortunately, the resulting corn and tomatoes were not subjected to organoleptic testing or nitrate analysis.



Field windrow turning of composted cattle manure with a Brown Bear auger turner.