



New Evidence Confirms the Nutritional Superiority of Plant-Based Organic Food



PRESENTED BY:
Charles Benbrook, PhD
The Organic Center
cbenbrook@organic-center.org



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**ORGANIC or CONVENTIONAL FOODS --
More nutritious? Better for the environment?**

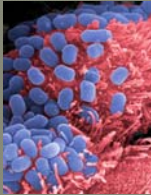
Major Differences Between Organic and Conventional Food and Farming

Three of five major food safety concerns largely eliminated

- Pesticides
- Animal drug residues/antibiotic resistance
- GM food risks (e.g., novel allergens)

Help manage two other major food safety risks:

- Mycotoxins
- Bacterial contamination



Major Differences Between Organic and Conventional Food and Farming

Worker Safety


Environmental Impacts

- Build soil quality
- Increase terrestrial carbon sequestration
- Promote biodiversity
- Lower energy inputs

Reduce impacts on birds, fish, pets, small mammals


Increase N use efficiency

Reduce the size of the Dead Zone in the Gulf

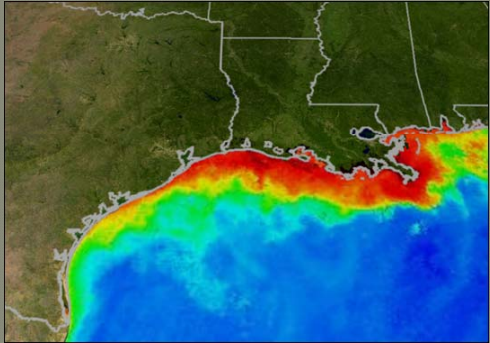


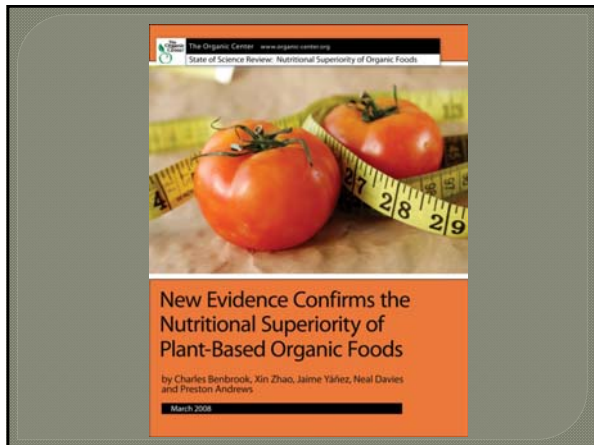
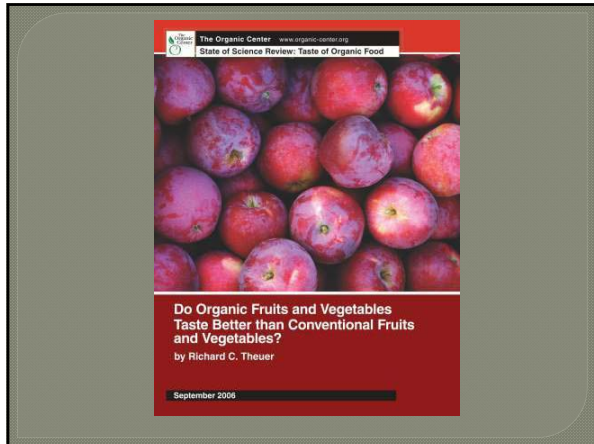
Environmental Impacts

- Build soil quality
- Increase terrestrial carbon sequestration
- Promote biodiversity
- Lower energy inputs



Reduce the size of the Dead Zone in the Gulf





Do scientifically valid comparative studies of the nutrient content in organic and conventional foods favor organic, conventional (or neither) production system?

What is the magnitude of differences for key nutrients between organic and conventional foods?


A rapidly expanding database to compare nutrient density

Number of Peer-Reviewed Studies Comparing the Nutrient Content of Organic and Conventional Food													
	2007	2006	2005	2004	2003	2002	2001	2000	1999-1995	1994-1990	1989-1980	Pre-1980	Total
Number of Published Studies	10	7	15	8	4	1	5	5	14	11	8	0	88

45% of the included studies were published 2004 through September 2007
 55% of studies – 1980 through 2004

Approximately 10-15 new studies per year are anticipated, half in the *Journal of Agricultural and Food Chemistry*

Matched Pairs




17 rules used to guide the selection of matched pairs.


Needed to minimize or eliminate factors that could confound, mask or skew real differences in nutrient levels

Agronomic Practices Screen

- Cultivar
- Production methods
- Location
- Soil type and topography
- Nutrient levels and fertilization
- Pest control
- Cultural practices



Analytical Methods Screen




Focus on individual methods by food and/or crop

Published methods acceptable, unless reported methods raise questions, e.g.
Baseline resolution
Separation

CV or RSD < 16% or bias percentile lower than 12%

Outlier values trigger additional investigation



VITAMINS

Matched pairs = 67

Organically grown higher = 41
Conventionally grown higher = 26



MINERALS

Matched pairs = 65

Organically grown higher = 34
Conventionally grown higher = 29



ANTIOXIDANTS

Matched pairs = 59

Organically grown higher = 44
Conventionally grown higher = 13

Overview of differences in the nutrient content in the organic and conventional foods in 236 matched pairs

Nutrient Class	Number of Matched Pairs	Number Organic Higher	Number Conventional Higher
Antioxidants	59	44	13
Vitamins	67	41	26
Minerals	65	34	29
Nitrates	18	3	15
Protein	27	4	23

Results Overview

- Out of 236 valid matched pairs, organic foods were nutritionally superior in 61% of the cases
- Organic samples contained higher concentrations of polyphenols and antioxidants in 75% of the matched pairs representing those nutrients

Plant-Based Organic Foods



MAGNITUDE of the DIFFERENCES in NUTRIENT CONTENT

ON AVERAGE IN THE ORGANIC SAMPLES –

TOTAL ANTIOXIDANT CAPACITY was 88% higher
 TOTAL PHENOLICS, 72% higher
 QUERCETIN, 87% higher
 KAEMPFEROL, 55% higher

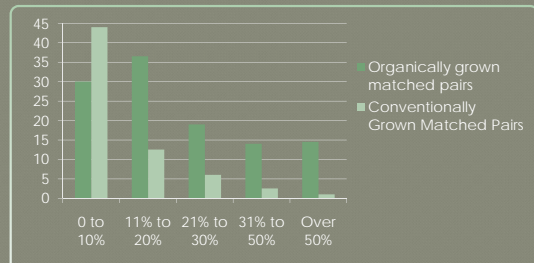


PROTEIN was 85% higher in the conventional samples



NITRATES were 83% higher in the conventional samples

Magnitude of differences in vitamin, mineral, and antioxidant levels in 189 matched pairs



Key new studies published after the March 2008 report



S.H. Wang et al., "Fruit Quality, Antioxidant Capacity, and Flavonoid Content of Organically and Conventionally Grown Blueberries," *Journal of Agricultural and Food Chemistry*, published on web July 1, 2008.

F. Beltran-Gonzalez et al., "Effects of agricultural practices on instrumental colour, mineral content, carotenoids composition, and sensory quality of mandarin orange juice, cv. Hemandina," *Journal of the Science of Food and Agriculture*, 2008

Intriguing Results Presented at Today's BioAg Symposium at WSU

Work by Preston Andrews, Neal Davies, and graduate students. Partial support from The Organic Center.

Three varieties; comparable levels of N, but different sources of N; and conventional and organic systems



WSU Tomato Study Findings and Implications

As expected, nutrient levels declined in conventionally managed plants as yield and average fruit size increased

No decline in nutrient concentrations seen in the organic plants

Implication – organic management may be able to sustain nutrient density at higher yield levels than conventional systems (more work underway to confirm)



Why are organic fruits and vegetables generally more nutrient dense?

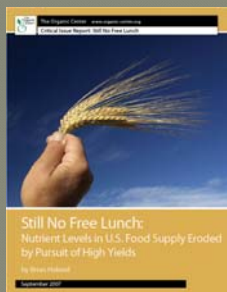
- Dilution effect
- Growth patterns and rate
- Plant defenses and response to stress
- Impacts of nitrogen on sugar levels and metabolism



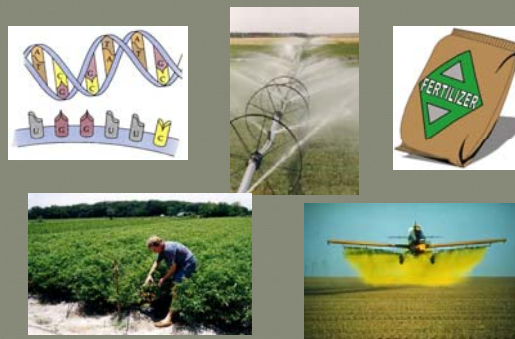
The Dilution Effect

Term was first used in *Advances in Agronomy*, WM Jarrell WM, RB Beverly, 1981; 34:197-224.

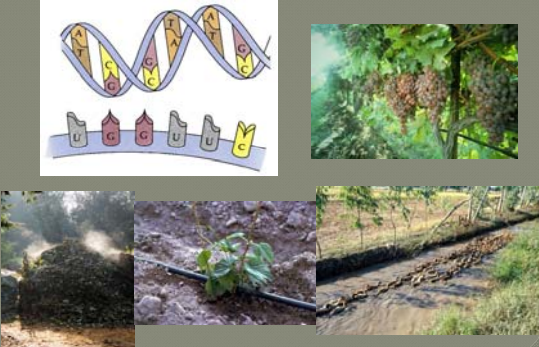
For more see "Still No Free Lunch: Nutrient Levels in the U.S. Food Supply Eroded in Pursuit of Higher Yields", by Brian Halweil, available from the Organic Center website - www.organic-center.org




Factors that often decrease nutrient density



Factors that often increase nutrient density




Plant defenses and response to stress



Impacts of nitrogen on sugar levels and metabolism


Conventional systems dependent on high nitrogen fertilization rates will produce:

- Faster growth, bigger fruit, larger average cell size (factors leading to the 'dilution effect')
- Higher levels of protein, carotenoids, and nitrates
- Less intense flavors and shorter shelf life
- Greater susceptibility to pathogens and insects



Impacts of high – N production systems on fresh produce

- More sugar and moisture, less Vitamin C
- Greater percentage of nutrients in glycosylated form, plus often more complex and stable forms of glycosylation
- Can push plants into a diabetes-like syndrome, with serious plant health (and food quality) consequences



Human Health Implications



- Reduced bioavailability of nutrients
- Insulin resistance and increased risk of diabetes
- More Advanced Glycation Endproducts (AGEs) in the food supply, especially burnt and/or fried foods

Good News for Human Health

Nutrient dense organic fruits and vegetables can reduce the total calories needed to meet daily nutrient needs



Good News for Human Health

More intense flavors in organic produce may help trigger satiety, lessening the tendency toward excessive caloric intake



Looking Ahead

Role of plant breeding and GM foods?

Renewed focus on food quality-health linkages?

Policy changes reward farmers for food quality enhancement?

Will Americans recognize the limits of therapeutic interventions, and need to invest in preserving good health?



Is increasing yield REALLY the ultimate goal?



Thank you for your attention

More information:
www.organic-center.org