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

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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
Organic production often improves organoleptic quality

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

A rapidly expanding database to compare nutrient density

<table>
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<tr>
<th>Number of Peer-Reviewed Studies Comparing the Nutrient Content of Organic and Conventional Food</th>
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<td>Number of Published Studies</td>
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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
**Agronomic Practices Screen**

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

**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.

**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 = 54
- Conventionally grown higher = 13
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.

**ON AVERAGE IN THE ORGANIC SAMPLES—**

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

**MAGNITUDE of the DIFFERENCES in NUTRIENT CONTENT**

- PROTEIN was 85% higher in the conventional samples.
- NITRATES were 83% higher in the conventional samples.
Key new studies published after the March 2008 report


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 Jamieson WM, RB Beverly, 1981; 34:197-224.


Factors that often decrease nutrient density
Factors that often increase nutrient density

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
- 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
- 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

Plant defenses and response to stress

Impacts of nitrogen on sugar levels and metabolism

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Impacts of high – N production systems on fresh produce

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Good News for Human Health

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

Human Health Implications
**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