Is Organic Healthier? The Science Supporting Organic Foods

Charles M. Benbrook Ph.D.
Kathleen Merrigan Ph.D.
Dr. Alan Greene

Natural Products Expo East
Washington, D.C.
October 15, 2004

Overview of Session

Chuck Benbrook

- Organic Center 101
- Release of the Executive Summary, Pesticide Residue State of Science Review

Dr. Alan Greene

- Off to a Healthy Start: Why Mothers Should Seek Out Organic Food

Kathleen Merrigan

- Overview of Organic Center work on antioxidants and polyphenols

Organic Center 101

Our Mission

…to promote research and science-based consumer education on the human health and environmental benefits of organic food and farming systems.

Organic Center 101

The Challenge

More and better scientific evidence is needed to prove and quantify the many different benefits that are associated with organic food and farming systems.

Organic Center 101

Science-Side Activities

- State of Science Reviews (SSRs)
- Identifying research priorities and finding ways to initiate and fund priority projects
- Highlighting "Hot Science"
http://www.organic-center.org/science.htm?groupid=8

Organic Center 101

Consumer-Side Activities

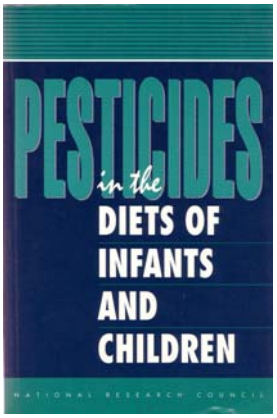
- Tracking consumer attitudes, interests, and understanding of the organic benefit
- Providing information that brings home to people the nature of the organic benefit

Consumer-Side Activities, cont.

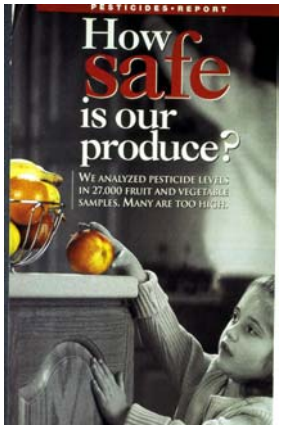
- Helping organic farmers, food companies, and the retail sector communicate the latest scientific findings in clear and meaningful ways

Who Guides the Work of the Organic Center?

- 14 member Board of Directors
http://www.organic-center.org/about.htm
- 26 member Scientific and Technical Advisory Committee (STAC)
http://www.organic-center.org/about3.htm
- 25 member Communications and Education Committee (C&E)



Consumer Reports
February 1999



New FAO-UNEP-WHO Report

- 1-5 million kids are poisoned every year
- 99% of deaths are in developing countries
- Malnutrition and dehydration increase susceptibility

Differences in pesticide risk from dietary exposure are a function of:

1. Frequency of residues (e.g., percent of samples testing positive)
2. Number of residues per sample
3. Residue levels found
4. Toxicity of the pesticide

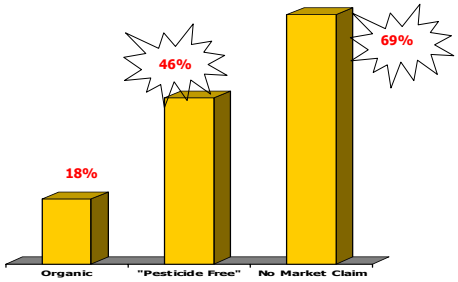
Pesticide Dietary Exposure SSR presents data on 1-3. Other SSRs will cover toxicity issues.

Pesticide Dietary Exposure SSR

Comparison of pesticide residues in conventional and organic foods

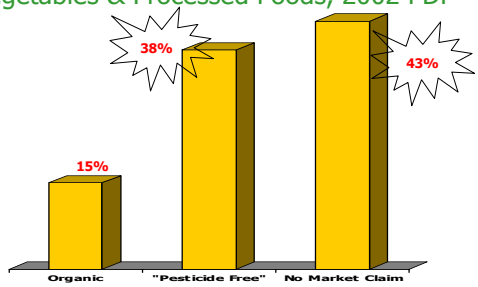
- by type of food
  - ✓ Fruits, Vegetables, Processed Foods, Grains, Milk/Meat based foods
- by year
  - ✓ 1993-2002, 2002
- by country of origin – domestic and imported

Frequency of residues: Fresh fruits, vegetables & processed foods, 1993-2002 PDP



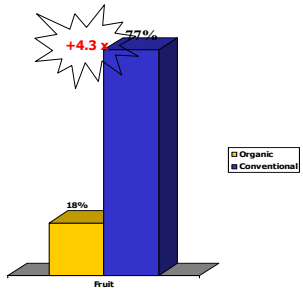
Source: Pesticide Data Program (PDP) 1993 - 2002; Benbrook Consulting Services/EcoLogic, 2004

Frequency of Residues: Fresh Fruits, Vegetables & Processed Foods, 2002 PDP



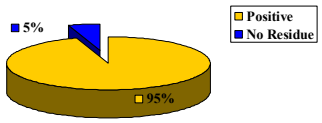
Source: Pesticide Data Program (PDP) 2002; Benbrook Consulting Services/EcoLogic, 2004

Frequency of residues in organic and conventional fruit, PDP 2000-2002



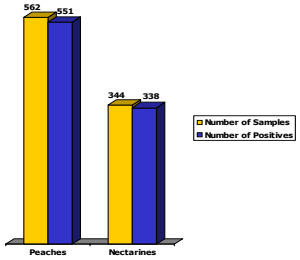
Source: Pesticide Data Program (PDP) 2000 - 2002; Benbrook Consulting Services/EcoLogic, 2004

Positives samples in fruit, PDP 1993-2002



Source: Pesticide Data Program (PDP) 1993 - 2002; Benbrook Consulting Services/EcoLogic, 2004

Frequency of residues in conventional peaches (2002) and nectarines (2000), PDP



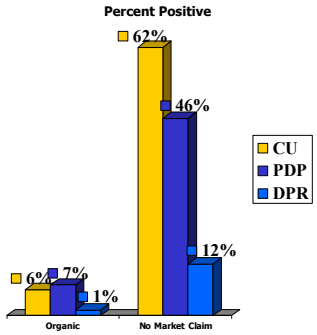
Source: Pesticide Data Program (PDP) 2000 - 2002; Benbrook Consulting Services/EcoLogic, 2004

Multiple Residues

- are surprisingly common
- increase the chances of additive/synergistic health effects
- must be taken into account to accurately assess health risks

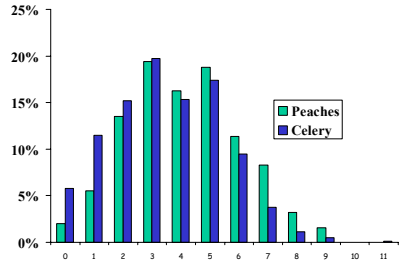
www.organic-center.org

Multiple residues in three datasets



Source: Baker et al., Food Additives and Contaminants, 2002, Vol 19, No. 5, 427-446

Multiple residues in peaches and celery, 2002 PDP



What are the odds?

A consumer buying conventional peaches is >11 times more likely to choose fruit with 7 or more residues than fruit with no residues.

Average peach had 4.25 residues

Celery: Five or more residues as likely as a sample with 1 or 0 residues.

Average celery sample had 3.7 residues

How risky is that residue?

- Serving size (grams consumed)
- Body weight (kilograms)
- Residue level (mg/kg of food, or ppm)
- Toxicity of pesticide (acute and chronic Reference Dose)

www.organic-center.org

Crop Pesticide Data Pairs (CPDP)

Comparison of the MEAN RESIDUE

PEACH
PHOSMET

Organic	No Market Claim
0.011 ppm	0.082 ppm

Ratio 7.45

CELERY
CHLORTHALONIL

Organic	No Market Claim
0.005 ppm	0.397 ppm

Ratio 79.5

POTATO
CHLORPROPHAM

Organic	No Market Claim
0.322 ppm	2.62 ppm

Ratio 8.16

Chlorpyrifos residues in peaches by country of origin and ranked by residue level, 2002 PDP

Rank	Country	Market Claim	Residue Level
1.	Chile	No Market Claim	0.079
2.	Chile	No Market Claim	0.078
3.	Chile	No Market Claim	0.071
4.	Chile	No Market Claim	0.056
5.	Chile	No Market Claim	0.049
6.	Chile	No Market Claim	0.048
7.	Chile	No Market Claim	0.047
8.	Chile	No Market Claim	0.046
9.	Chile	No Market Claim	0.045
10.	Chile	No Market Claim	0.043
11.	Chile	No Market Claim	0.042
12.	Chile	No Market Claim	0.038
13.	Chile	No Market Claim	0.037
14.	U.S.	No Market Claim	0.036
15.	Chile	No Market Claim	0.036

94 of top 100 peach residues were from Chilean samples

ORGANIC PRODUCTION

What about risks from pesticides allowed in organic production?

- Spurious claims often made by critics of organic – backed by no data
- Organic farmers DO use pesticides, but much less toxic ones and much less often
- Public education is needed about the difference between conventional and organic pest management systems and risks

www.organic-center.org

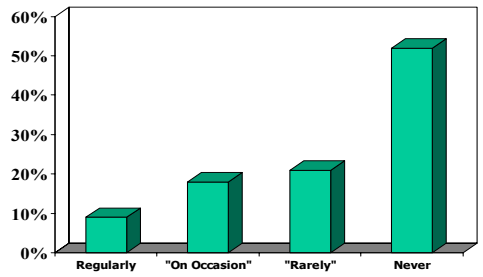
ORGANIC PRODUCTION

Natural and biochemical pesticides allowed

- sulfur
- horticultural oils
- copper based fungicides
- *Bacillus thuringiensis (Bt)*
- azadirachtin (neem)
- spinosad
- soaps
- repellants
- botanical insecticides
- pheromones
- natural plant growth regulators
- other microbial pesticides

Use of botanical* insecticides used in organic farming

*Primarily neem and pyrethrin



Source: Waltz,E., *Final Results of the Third Biennial National Organic Farmers' Survey*. Organic Farming Research Foundation, Santa Cruz, CA. 1999

ORGANIC PRODUCTION

Residues and risk issues

- Sulfur – widely used in both conventional and organic farming systems with no risk concerns (natural element)
- Copper – same as sulfur
- Pyrethrins – very low rate of application (~0.01 pound per acre). Breaks down very quickly. Near zero risk of residues

ORGANIC PRODUCTION –
residues and risk issues

- Rotenone – Minimal use. 0.01 pound/acre application rate. Not persistent, near zero dietary risk.
- Sabadilla – only used on citrus at a very low application rate of 0.02 pounds/acre. Near zero risk, partly due to the presence of a peel

ORGANIC PRODUCTION –
residues and risk issues

- Spinosad – low rate of application. Residue found in ~ 1/3 treated nectarines. Low levels are found (0.006 – 0.029 ppm). Low toxicity level, RfD=0.0268. Spinosad is 268 times less toxic than the high-risk organophosphates and carbamates

Key finding in *Pesticide Dietary Exposure SSR*

Extensive and highly sensitive pesticide residue testing carried out by the U.S.D.A. shows that conventionally grown fruits and vegetables are --

- Three to over four times more likely, on average, to contain residues than organically grown produce.
- Eight to 11 times more likely to contain multiple pesticide residues than organically grown produce.
- Contain residues at levels three to 10 times higher, on average, than corresponding residues in organic fruits and vegetables.

KEY FINDING

Heavily contaminated fruits and vegetables frequently consumed by infants and children

- Apples
- Pears
- Peaches
- Nectarines
- Strawberries
- Cherries
- Celery
- Spinach
- Sweet bell peppers

Alan Greene, MD, FAAP

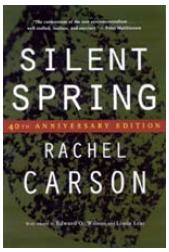
Founder, DrGreene.com
Author, *First Kicks to First Steps*
Assistant Clinical Professor
Stanford University School of Medicine

Natural Products Expo East
Washington, D.C.
October 15, 2004

Premature birth: A silent crisis

Every day 1 in 8 babies born in the U.S. arrives too soon. Premature birth can happen to any woman and be life threatening for her baby

March of Dimes



Silent Spring
by Rachel Carson
Boston, Houghton Mifflin Company (2002)

Association between Maternal Serum Concentration of the DDT Metabolite DDE and Preterm and Small-for-Gestational Age Babies at Birth

The Lancet
Volume 358, Number 9276. Pages 110-114.
July 14, 2001

DDT and DDE Exposure in Mothers and Time to Pregnancy in Daughters

The Lancet
Volume 361, Number 9376
Pages 2205-6
June 28, 2003

www.organic-center.org

	Sun	Mon	Tues	Weds	Thurs	Fri	Sat
OCTOBER						1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
2004	31						

Detection of Endocrine Disrupting Chemicals in Samples of Second Trimester Human Amniotic Fluid

Journal of Clinical Endocrinology and Metabolism
Volume 85, Number 8
Pages 2954-7
August 2000

www.organic-center.org

Association of *in Utero* Organophosphate Pesticide Exposure and Fetal Growth and Length of Gestation in an Agricultural Population

Environmental Health Perspectives
Volume 112, Number 10
Page 1116
July 2004

www.organic-center.org

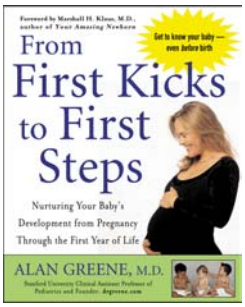
Prenatal Insecticide Exposures, Birth Weight and Length Among an Urban Minority Cohort

Environmental Health Perspectives
Volume 112, Number 10
Page 1125
July 2004

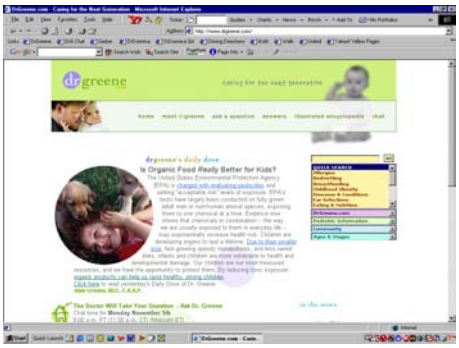
Organophosphorus Pesticide Exposure of Urban and Suburban Pre-school Children with Organic and Conventional Diets

Environmental Health Perspectives
Volume 111, Number 3
Page 377
March 2003

FOR MORE INFORMATION



DRGREENE.COM



Kathleen Merrigan, Ph.D.

Assistant Professor
Director, Agriculture Food and Environment Program
Friedman School of Nutrition Science and Policy
Tufts University
Boston Massachusetts

Natural Products Expo East
Washington, D.C.
October 15, 2004

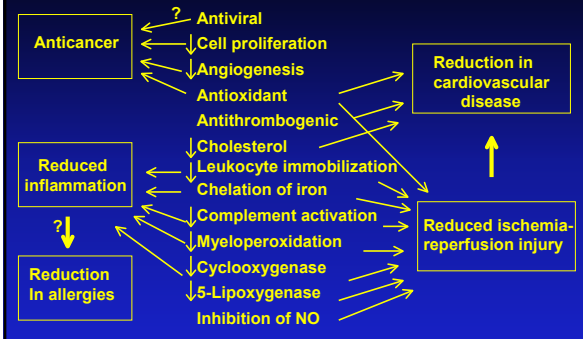
Impacts of organic farming and processing on antioxidant levels

- Priority area for the organic center
- SSR scheduled for release in late 2004

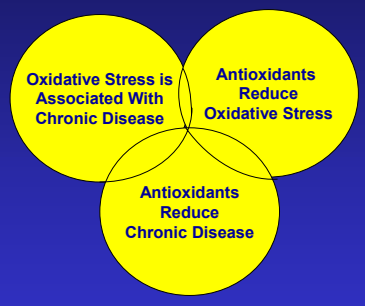
Three projects initiated in 2004

- World Vegetable Center
  - ✓ lycopene in tomatoes
- WSU Team
  - ✓ strawberry fruit quality
- Tufts University
  - ✓ test methodologies and preliminary assessment of comparative levels

Potential Links Between Flavonoid Mechanisms and Disease



Nijveldt et al. *Am J Clin Nutr* 2001



Chronic Degenerative Diseases Associated With Free Radical Damage

- Adult respiratory distress syndrome
- Age-related macular degeneration
- Alcoholism
- Aluminum neurotoxicity
- Alzheimer's disease
- Cancer
- Cardiovascular disease
- Cataracts
- Diabetes
- Down syndrome
- Familial amyotrophic lateral sclerosis
- Hemorrhagic shock
- Inflammation
- Ischemia
- Pancreatitis
- Parkinson's disease
- Porphyria
- Rheumatoid arthritis

Institute of Medicine
Food and Nutrition Board
Panel on Dietary Antioxidants and Related Compounds

Criteria for defining an antioxidant:

1. The substance is found in human diets.

2. The content of the substance has been measured in foods commonly consumed and can be calculated from available national databases.

3. In humans, the substance decreases the adverse effects of ROS and RNS *in vivo*.

National Academy Press 1998

Antioxidant Defense Network

Endogenous	Exogenous
ENZYMATIC	ascorbic acid
catalase (Fe)	tocopherols/tocotrienols
glutathione peroxidase (Se)	carotenoids
superoxide dismutases (Mn, Cu/Zn)	phenolic acids
CELLULAR	polyphenolics
glutathione	
α-lipoic acid	
ubiquinone	
uric acid	
PROTEIN	
ceruloplasmin	
ferritin	
transferrin	

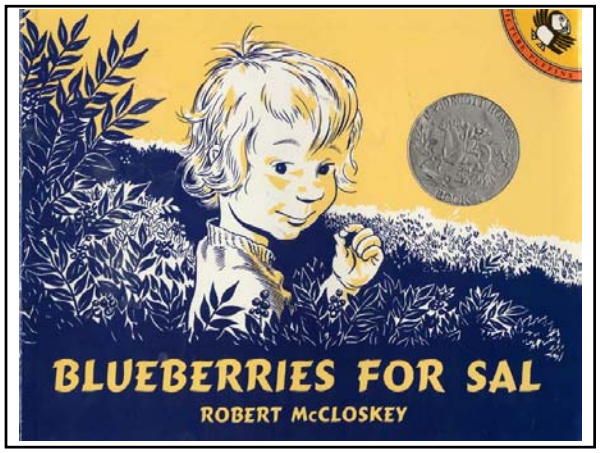
Flavonoid Consumption in Several Countries

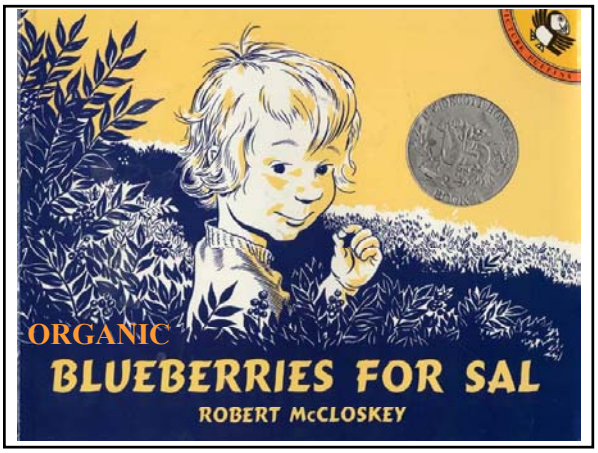
Country	Flavonoids Evaluated	Intake (mg/d)
Holland	2 flavones + 3 flavonols	23
	6 flavan-3-ols	50
	4 isoflavones	<1
	total	*73*
Japan	1 flavone	<1
	4 flavonols	16
	2 isoflavones	47
	total	*63*
United States	2 flavones	<1
	3 flavonols	20-22
	4 isoflavones	<1
	2 isoflavones	12
	total	*20-34*

Flavonoid Consumption in Several Countries

Country	Flavonoids Evaluated	Intake (mg/d)
Denmark	3 flavanones	7-14
	1 flavone	1-2
	2 flavonols	15-30
	total	*23-46*
Finland	3 flavanones	20
	2 flavones	<1
	4 flavonols	4
	total	*24*

Dragstead et al. *Eur J Can Prevention* 1997, Knekt et al. *Am J Clin Nutr* 2002, Hertog et al. *Nutr Cancer* 1993, Arts et al. *Eur J Clin Nutr* 2001, Boker et al. *J Nutr* 2002, Arai et al. *J Nutr* 2000, Sampson et al. *J Am Diet Assoc* 2002, de Kleign et al. *J Nutr* 2001, Wu et al. *Carcinogenesis* 2002


BLUEBERRIES FOR SAL
ROBERT McCLOSKEY


ORGANIC
BLUEBERRIES FOR SAL
ROBERT McCLOSKEY