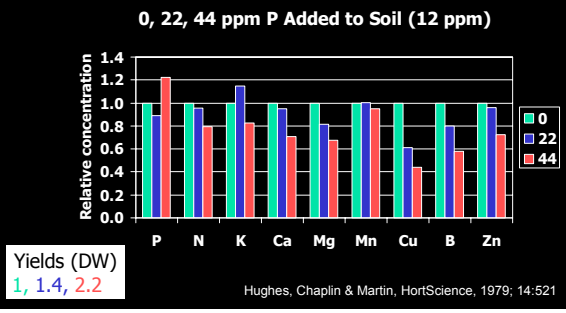
Trends in the Nutrient and Antioxidant Content of Common Foods

Donald R. Davis
The University of Texas at Austin and
Bio-Communications Research Inst., Wichita, KS

"The Dilution Effect in Plant Nutrition Studies"

- Jarrell WM, Beverly RB. Advances in Agronomy, 1981; 34:197–224 (101 refs.)
- Yield-enhancing methods tend to decrease nutrient concentrations
  - Fertilization, irrigation & timing (all environmental)
- The dilution effect is well known among agronomists & horticulturists, who seldom give a citation when they mention it
- 169 citations in Science Citation Index

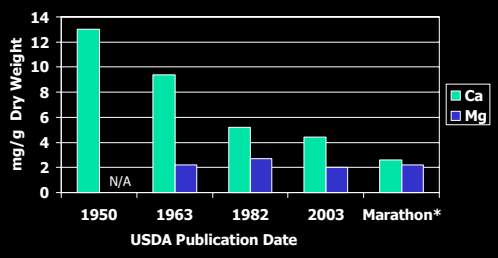
Dilution Effect of Phosphorus in Red Raspberry Plants



Yields (DW)
1, 1.4, 2.2

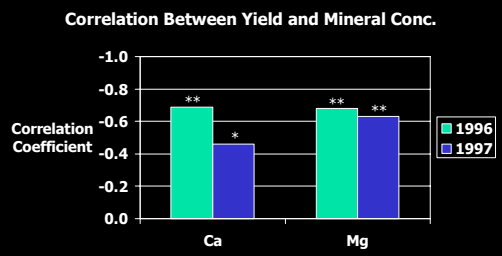
Hughes, Chaplin & Martin, HortScience, 1979; 14:521

Ca & Mg Trends in Broccoli



* Farnham, Grusak & Wang, J Amer Hort Sci, 2000; 125:344

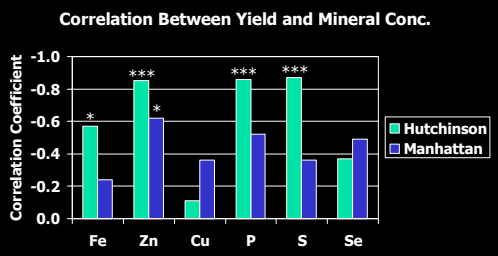
Dilution Effect of Yield in 27 Commercial Broccoli Hybrids



* P < 0.05
** P < 0.01

Farnham, Grusak & Wang, J Amer Hort Sci, 2000; 125:344

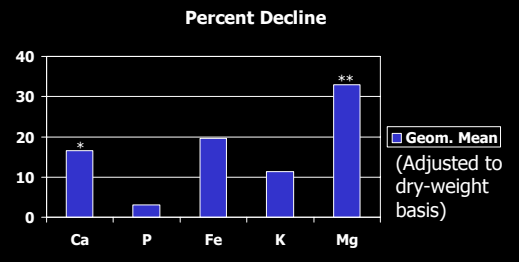
Dilution Effect of Yield in 14 Wheats, Intro. 1873 to 1995



* P < 0.05
*** P < 0.001

Garvin, et al. poster, ASA/CSSA/SSSA meeting, 2002
Garvin, Welch & Finley, J. Sci. Food Agric., in press, 2006

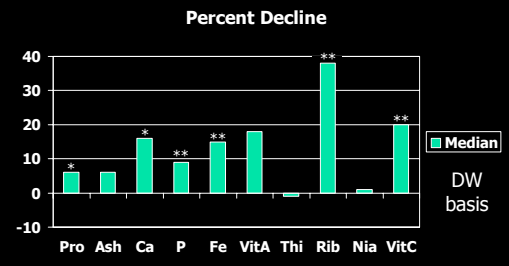
Trends in 20 Vegetables, United King., 1930s to 1980s



* P < 0.05
** P < 0.01

Mayer AM. Br Food J, 1997; 99:207

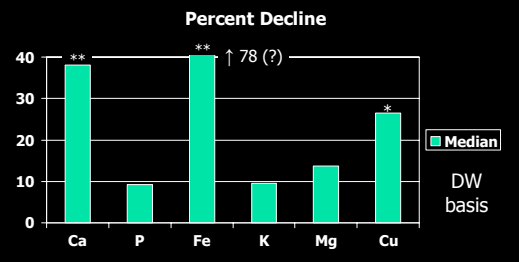
Trends in 43 Garden Crops, USDA data, 1950 to 1999



* P < 0.05
** P < 0.01

Davis, Epp & Riordan, J Am Coll Nutr, 2004; 23:669

Trends in 16-50 US Crops, 1930s to 2004 (reanalyzed)



* P < 0.05
** P < 0.01

White & Broadley, J Hort Sci Biotech, 2005; 80:660

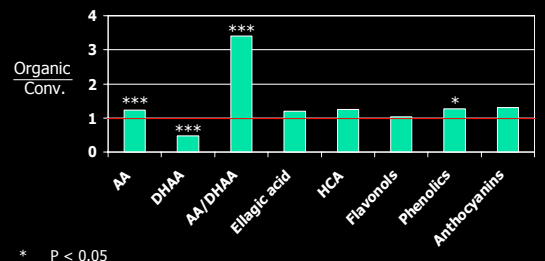
Other Trends in Agriculture

- Chemical fertilizers
- Herbicides, pesticides
- Low soil organic matter
- Evidence for other nutritional effects
  - Decreased secondary plant metabolites
  - Probable decreased ability to help prevent CHD, cancer, diabetes, Alzheimer's, aging
  - Increased nitrate levels

Emerging Evidence of Benefits of Organic Production Methods

- Average increases in antioxidants and secondary plant metabolites ~30%
- Probable enhanced disease prevention
  - CHD, cancer, diabetes, aging, Alzheimer's disease
- "Elevating Antioxidant Levels in Food Through Organic Farming and Food Processing"—The Organic Center, 2005, www.organic-center.org

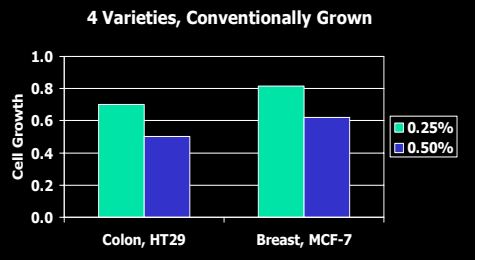
Antioxidants in 3 Organic Vs. 4 Conventional Strawberries



* P < 0.05
*** P < 0.001

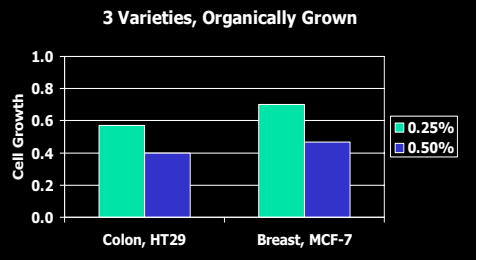
Olsson, Andersson, Oredsson et al., J Agric Food Chem, 2006; 54:1248

Suppression of Cancer Cell Growth by Strawberry Extracts



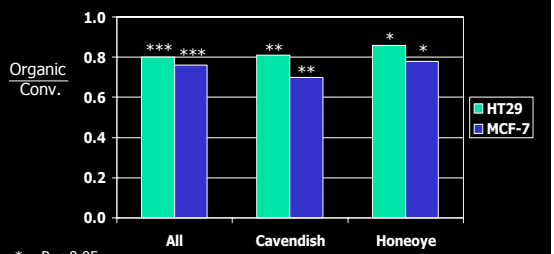
Olsson et al., J Agric Food Chem, 2006; 54:1248

Suppression of Cancer Cell Growth by Strawberry Extracts



Olsson et al., J Agric Food Chem, 2006; 54:1248

Superior Suppression by Organic Strawberries



* P < 0.05
** P < 0.01
*** P < 0.001

Olsson et al., J Agric Food Chem, 2006; 54:1248

Trends Summarized

- Environmental dilution effects
- Genetic dilution effects
- Historical comparisons consistent with dilution effects
- Decline in secondary plant metabolites implied by higher levels in organic crops

Nutrition in the United States

- Low intakes of nutrients (NHANES 2005)
  - Vit. E 93%, Mg 56%, vit. A 44%, vit. C 31%
  - Most get < Adequate Intake of vit. K, Ca, K, fiber
- Low intakes of recommended foods
  - Fruits—70% eat < 2 servings/day
  - Vegetables—58% eat < 3 servings/day
  - Whole grains—few eat half whole grains
- >50% calories from added sugars, added fats and white flour

Improving Nutrition

- Eat more fruits, vegetables, whole grains
- Eat less added sugars, added fats, flour
- Reduce the environmental and genetic dilution effects of high-yield crops
- Emphasize fruits & vegetables with high antioxidant levels (e.g., high ORAC)
- Eat foods grown & processed organically