

Farming for Fruit Quality and Health

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Fruit quality

Depends on stakeholder

- fruit growers
- graders/processors
- marketers
- consumers

Scientists - specific quantifiable measures

- priorities of consumers, growers, grading and processing enterprises, wholesale & retail marketers

Definition of fruit quality

- The standards of excellence of a product that distinguishes it as superior
- Composite of attributes
 - on-farm productivity
 - fruit maturity - "ripeness"
 - storage capacity - "keeping quality" & "shelf-life"
 - sensuous
 - nutritious
 - disease prevention
 - safe

Does Organic Production Enhance Phytochemical Content of Fruit and Vegetables?

Zhao et al., *HortTechnology* 16:449, 2006

"The evidence overall seems in favor of enhancement of phytochemical content in organically grown produce, but there has been little systematic study of the factors that may contribute to increased phytochemical content in organic crops. It remains to be seen whether consistent differences will be found, and the extent to which biotic and abiotic stresses, and ... soil biology contribute to those differences. Problems associated with most studies tend to weaken the validity of comparisons."

Farm System - Fruit Quality Criteria

Vertically oriented, quality attribute extensive studies with:

- matched soil, microclimate & crop variety
- alternatives in distribution system for storage, processing, transport & marketing
- consumer handling & preparation



Sustainability of three apple production systems

JP Reganold, JD Glover, PK Andrews & HR Hinman
Nature 410: 926, 2001


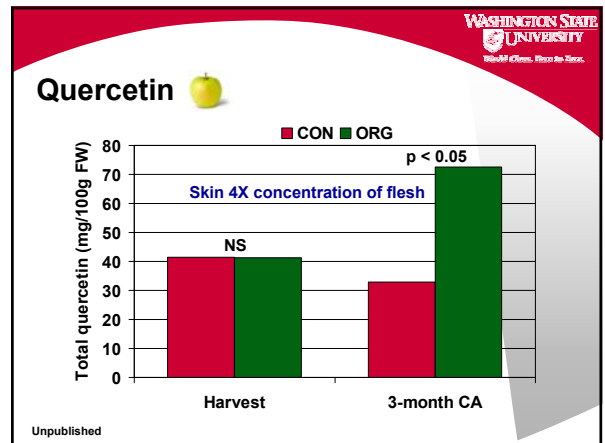
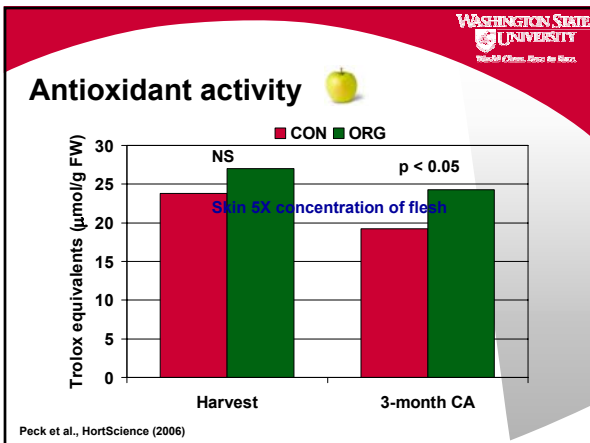
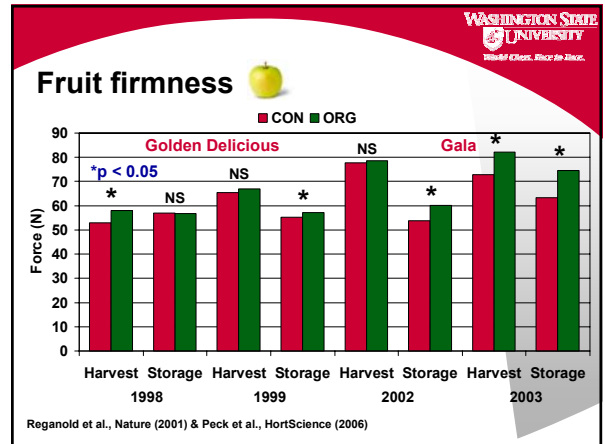
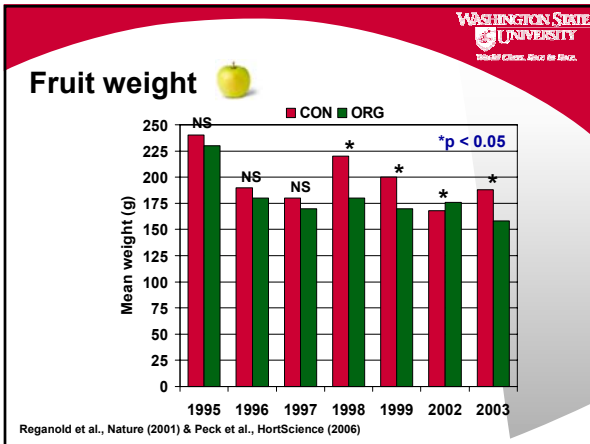
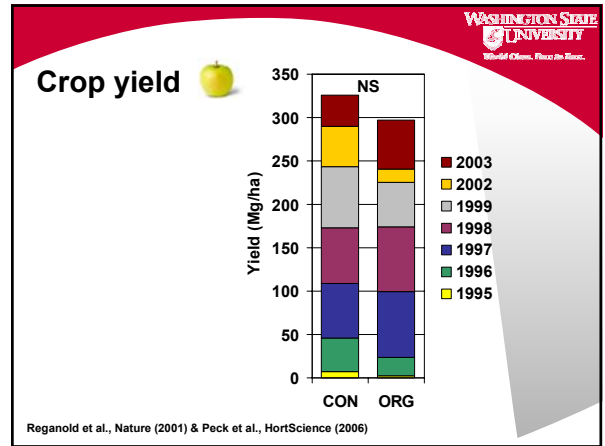
- Crop quality
- Soil quality
- Farm profitability
- Environmental risks of agrochemicals
- Energy efficiency

Apple orchard productivity and fruit quality under organic, conventional, and integrated management


GM Peck, PK Andrews, JP Reganold & JK Fellman
HortScience 41:99, 2006

Apple study

- Yakima County, Washington
- Replicated, on-farm
 - ORG, CON, INT
- Soil & topography identical
- Cultivars
 - 'Golden Delicious'
 - 'Gala'
- Grower/scientist managed

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Quercetin

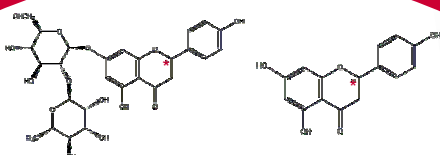
Oc1c(O)c(O)c(O)c2c(O)c(O)c(O)c12

“Researchers at Minnesota’s Mayo Clinic report that quercetin, ... found most abundantly in apples, may provide a new method for preventing or treating prostate cancer.” *Carcinogenesis* 22:409, 2001

“Researchers at the University of Hawaii found that increased consumption of quercetin was associated with a reduced risk of lung cancer.” *J. Natl. Cancer Inst.* 92:154, 2000

<http://www.usapple.org/educators/research/index.cfm>

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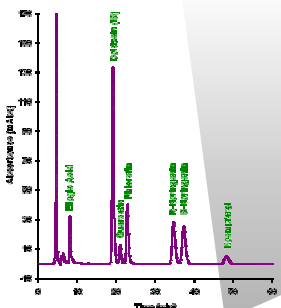
Naringin (glycoside) **Naringenin (aglycone)**

- chiral flavanone with R and S enantiomers
- citrus, tomato, apple, cherry
- anti-oxidant, -cancer, -mutagenic properties
- glycoside and aglycone forms of enantiomers have different bio-availabilities and bio-activities

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Evaluating polyphenolics

- chiral separation by high-performance liquid chromatography (HPLC)
- measure multiple polyphenolic compounds and any enantiomers
- evaluate anti-cancer, anti-inflammation, and anti-hyperlipidemia of pure compounds and fruit extracts



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Current research

Hypothesis:

- phytochemicals are “diluted” in conventional systems because of excess growth caused by too readily available nitrogen and/or selection of varieties for large fruits with high yields


Biologically Intensive & Organic Agriculture (BIOAg) project:

- small-, medium- and large-fruited tomato varieties grown under ORG or CON soil fertility
- monitor soil fertility/biology, measure growth, cell size and phytochemical “density,” assess anti-cancer activity

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Questions?
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