

Organic Stone Fruit Orchard Floor Management: Integration of management of arthropods, weeds, water use, and crop quality and nutrition

**Diane Alston¹, Andrew Tebeau¹, Jennifer Reeve²,
Brent Black², Corey Ransom², Marc Rowley²,
Ruby Ward³, and Silvana Martini⁴**

Utah State University

¹Biology, ²Plants, Soils and Climate, ³Applied Economics, and

⁴ Nutrition and Food Sciences



USDA NIFA Organic Agriculture Research and Extension Initiative (OAREI): 2009-13

- Critical Stakeholder Needs
 - Utah is a prime stone-fruit production area (peach & cherry)
 - Lack of successful organic role models
- Potential Economic, Social and Environmental Benefits
 - Highly urbanized state: Most of 2.8 mill residents live in ~150 mile-length Wasatch Front
 - Expanding local market opportunities
 - Water! Water! Water! (Quantity & Quality – alkalinity, salinity)

Utah OAREI: 2009-13

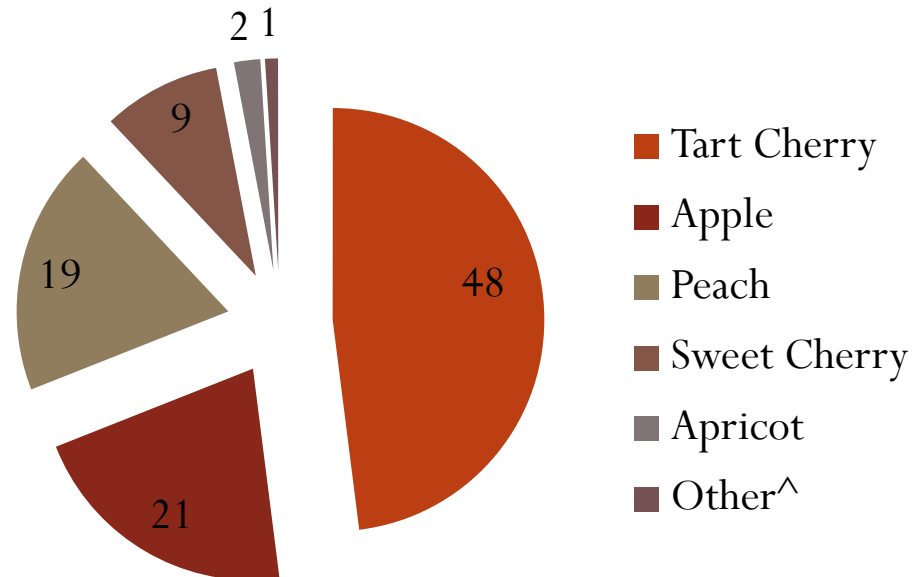
- Stakeholder Engagement
 - Well organized tree fruit grower organization
 - Research committee
 - Organic advisory committee
 - Long-standing relationship with USU
- Outreach Plan
 - Existing resources + Train-the-Trainer, Fruit Schools (North & South – inter-state: ID, W CO), Field Days, Organic Web content, Organic Chapter in UT/CO Commercial TF Guide

Utah's Tree Fruit Industry*

- 6,644 acres
- 306 operations

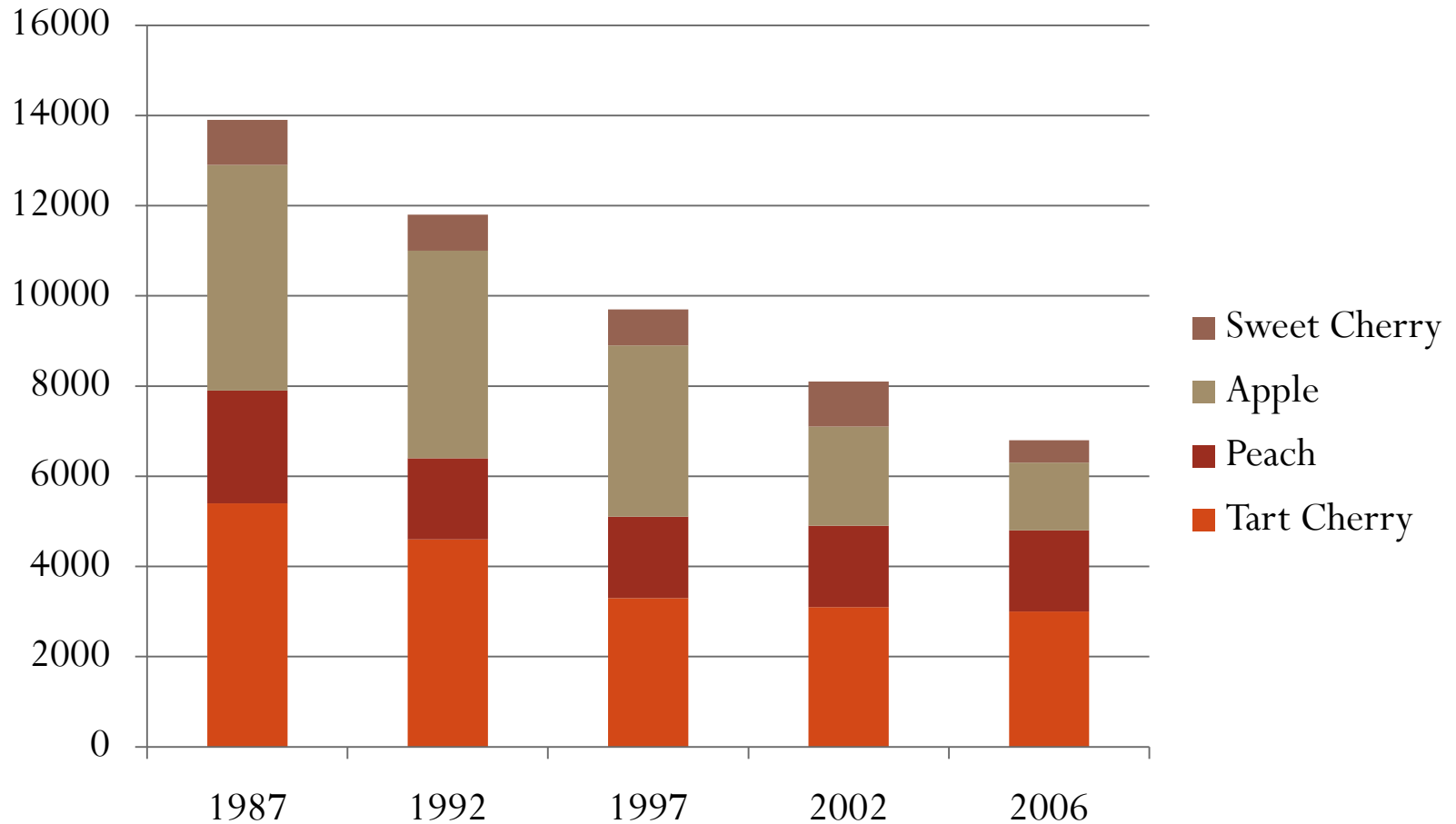
*Utah Tree Fruit and Berry Survey, 2006

Percentage of Tree Fruit
Acreage



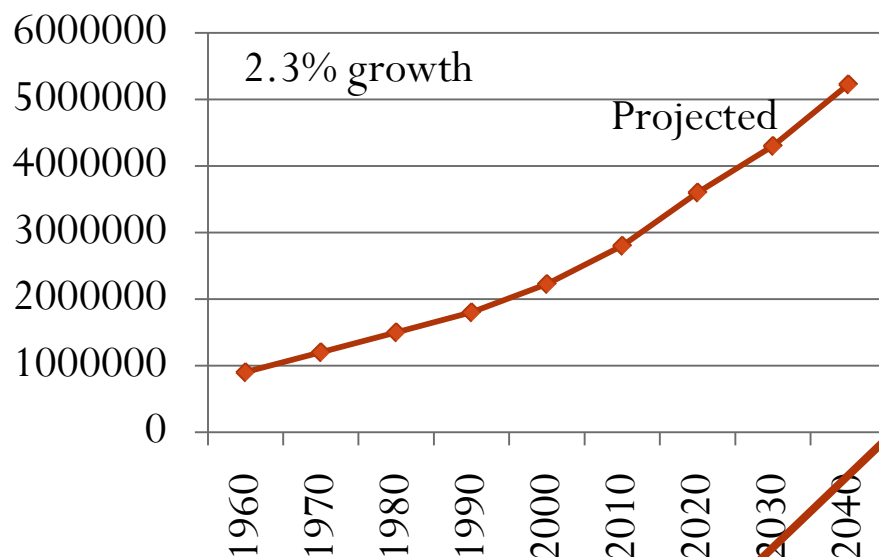
^Pear, Plum/Prune, Nectarine

Decline in Utah's Tree Fruit Industry: 1987-2006



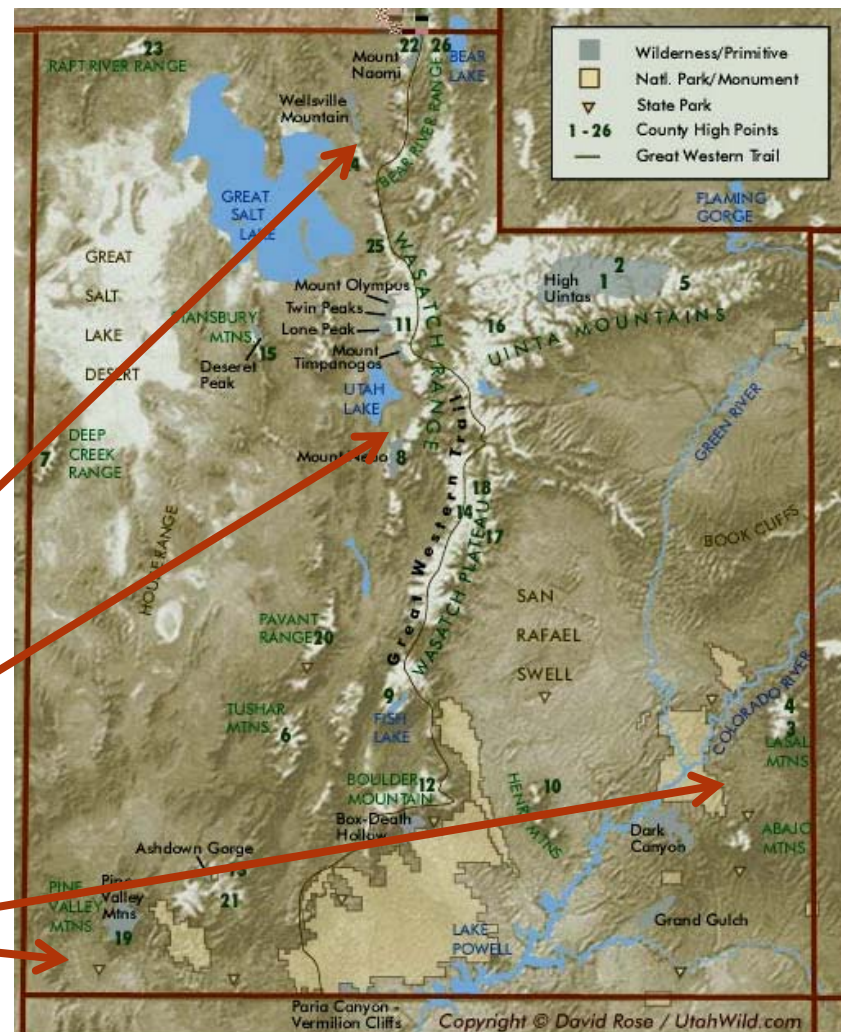
Utah's Tree Fruit Production and Human Population Increase

Utah's Population



Fruit Producing Regions

Utah Co.	78% of acreage
N. Wasatch	14%
Southwest	5%
Southeast	3%

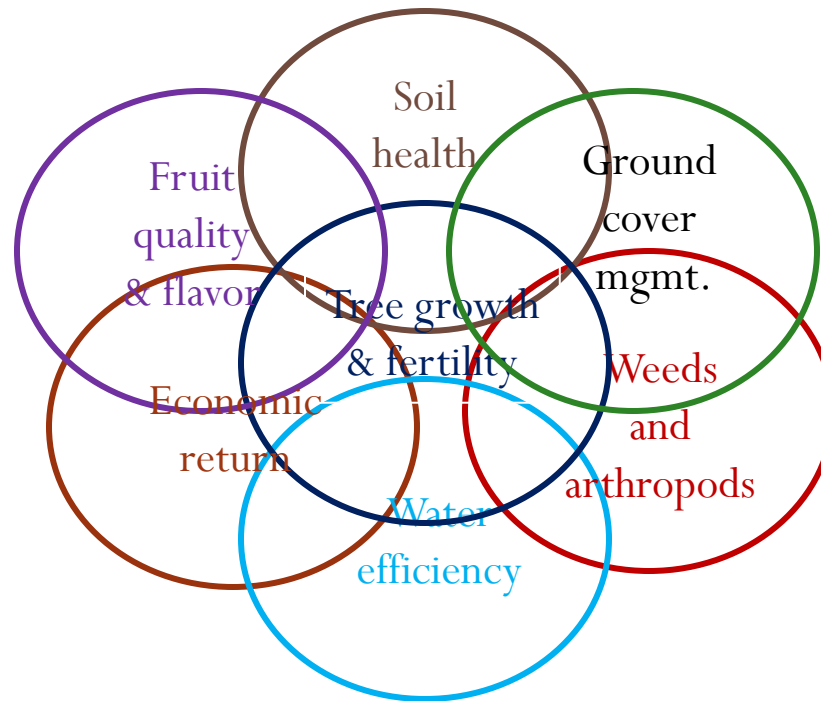


Utah OAREI Stone Fruit Project

- Objectives

1. Tradeoffs in water use efficiency and tree growth with living and non-living mulches, internal and external fertility inputs, and soil quality
2. Weed and arthropod response to organic management practices
 - Orchard floor cover / organic management
3. Evaluate orchard floor cover crops to optimize weed suppression, arthropod dynamics, water use, and early season N release
 - Utah orchards have cold winters, arid summers and shallow, alkaline soils
4. Evaluate orchard floor management for optimum fruit quality, environmental benefit, and economic return
5. Increase adoption of stone fruit organic production through education and outreach

Utah Stone Fruit Project Component Integration



Utah Stone Fruit Project

Relevant Background

- Orchard floor mgmt., weeds & fertility are major concerns in organic tree fruit production (Hoaglund et al. 2008, Skroch & Shribbs 1986)
 - Competition – weeds, ground cover veg. (Parker & Meyer 1996), water (Nielsen & Hogue 2000)
 - Harbor pests – lygus, stink bug, spider mites (Epstein et al. 2007, Alston 1994)
 - Compost is \$\$
 - Legumes can supply N, but competition & timing of release is critical (Meyer et al. 2006, Antonelli et al. 1997)
 - Non-living mulches – do not compete, reduce temperatures, alter rodent activity, decrease nutrient & water penetration (Hoagland et al. 2008, Nunez-Elisea et al. 2005, Nielsen & Hogue 1992)
- Fruit quality and flavor
 - Aesthetics, texture, Brix, antioxidants (Reganold et al. 2001, Carbonero & Mattera 2001)

Utah Stone Fruit Project

Entomological Objectives

1. Management of key fruit-feeding pests (peach & cherry)
 - Lygus bug, European earwig, cherry fruit fly
 - Intra- and extra-orchard ground covers, trap crops, mulches, mechanical traps, attract-and-kill stations
 - Spatial and temporal attraction



Utah Stone Fruit Project

Entomological Objectives

2. Extra-floral nectaries of peach and cherry
 - Attraction & retention of arthropod pests and natural enemies



Utah Stone Fruit Project

Entomological Objectives

3. Evaluate effects of organic insecticide programs on natural enemy populations and biological control efficiency
 - Products
 - Timing / Frequency
4. Survey predators and parasitoids in organic stone fruit orchards



Orchard ground cover treatments

- Research peach orchards established in 2008
 1. Organic block
 - Compost + tillage
 - Compost + fabric mulch
 - Compost + straw mulch
 - Compost + alyssum living mulch
 - Compost + straw mulch + legume alleys
 - Compost + alyssum living mulch + legume alleys



Orchard ground cover treatments

2. Integrated block
- Conventional NPK + herbicides
 - Compost + herbicides
 - NPK + paper mulch + reduced herbicides
 - Compost + paper mulch + organic herbicides
 - NPK + herbicides – convert to organic once established



Preliminary results – 2nd year

- Tree growth in compost vs. conventional NPK (herbicides) was similar
 - Compost isn't a limiting factor
 - Quality & quantity critical
- Weed suppression with straw was poor, good with paper mulch & intermediate with alyssum
- Tree growth was reduced in organic and reduced herbicide vs. conventional herbicide treatments
 - Competition from weeds was greatest limiting factor so far





Extension resources

www.utahpests.usu.edu

- One-stop shopping for insect and plant disease info
- Over 150 fact sheets & bulletins
- Diagnostic image gallery
- Resources: slideshows, reports, etc.
- Utah Pests News: quarterly newsletter
- Portal to: IPM, Plant Diseases, Arthropods & CAPS

The screenshot displays the Utah Pests website interface. At the top left, there are links for 'exit home', 'site map', and 'exit directory'. Below these is the Utah State University Cooperative Extension logo. A vertical navigation menu on the left lists: 'home', 'fact sheets', 'frequently asked questions', 'image galleries', 'slideshows', 'utah pests news quarterly newsletter', and 'contact us'. The main header area includes a search bar with a 'GO' button and a dropdown menu for 'Extension Sites A-Z'. The central banner features a close-up image of a peach with a small hole, with the text 'UTAH PESTS' overlaid. Below the banner, a paragraph states: 'Utah's diverse landscape supports thousands of insects and plant pathogens. UTAH PESTS is your portal for learning more about pests and their beneficial counterparts around the state, and how Utah Extension personnel are working to provide a greater understanding of these organisms in our world.'

The website is organized into four main resource categories, each with a representative image and a brief description:

- integrated pest management**: Choose this site for the [plant pest advisories](#), the [IPM Mini-Grant program](#), [weather data](#), and much more.
- plant diseases**: Choose this site for a multitude of fact sheets on diseases and disorders of [field crops](#), [fruits](#), [ornamentals](#), [turf](#), and [vegetables](#).
- insects and their relatives**: This site will help to shed some light on the insect world, with [fact sheets](#), [images](#), [slide shows](#), and more.
- utah plant pest diagnostic lab**: The UPPDL, the only lab of its kind in Utah, is here to identify and provide management recommendations for your pest problems.

At the bottom, there is a section for the **cooperative agricultural pests survey**, featuring an image of a beetle and the text: 'CAPS is a federally-funded program that surveys for invasive pests throughout Utah.'



Utah IPM

Pest Advisory Program

(Free subscription service)

Tree fruits

Small fruits & veggies

Landscape ornamentals

Turf

Utah TRAPs

(Timing Resource and Alert for Pests)

Utah Climate Center

12 orchard sites (N UT)

Real-time weather data (10 min.)

ET

Pest models (insect & disease)





TRAPs

Insects:

% moth flight

% egg hatch

daily DD

Fireblight:

risk index

5-day history

4-day forecast

mgmt. actions

