Travelogue
International Fruit Tree Association
2015 Summer Study Tour
Washington State

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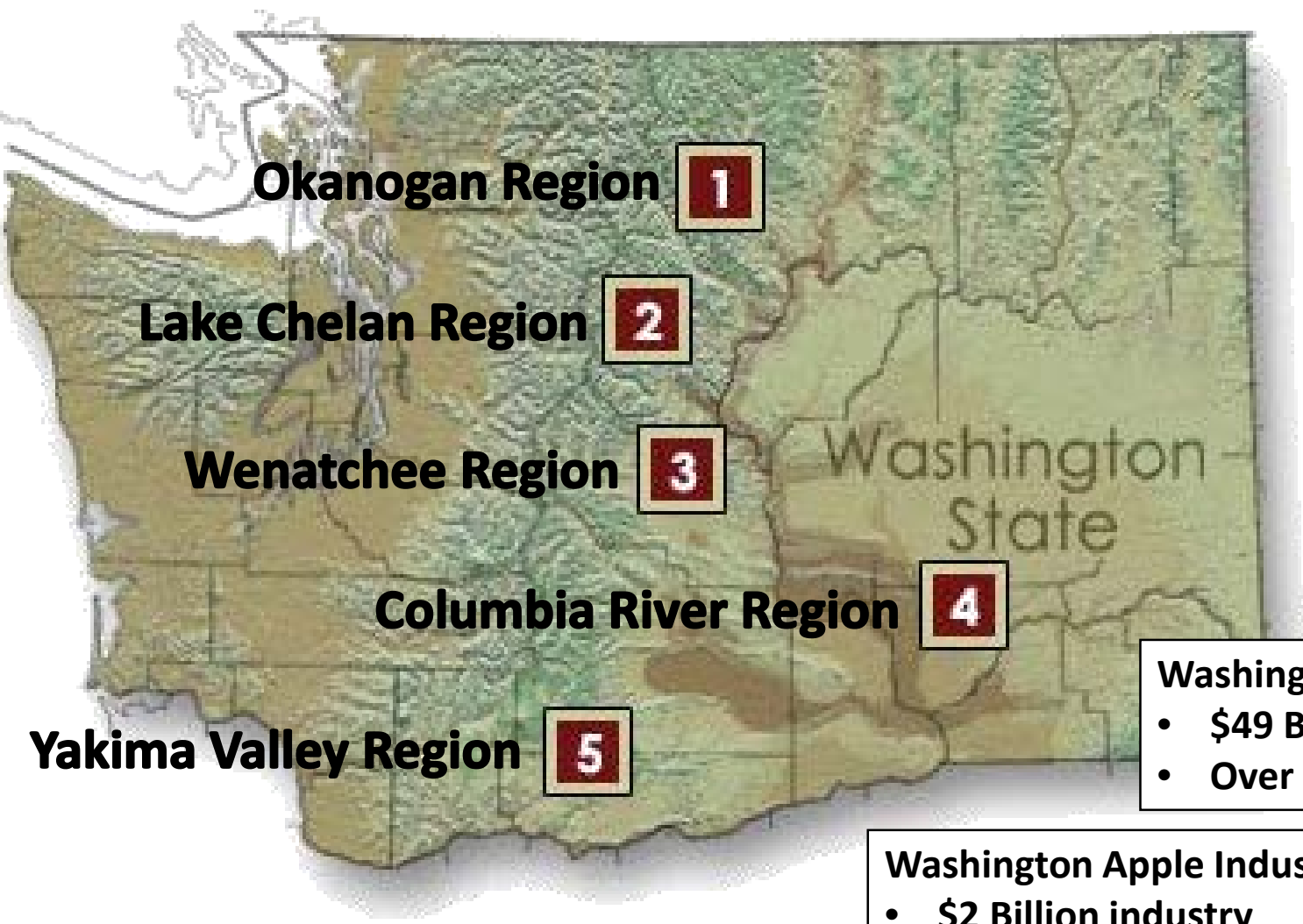


Washington Agriculture

- $49 Billion Industry
- Over 300 Commodities

Washington Apple Industry

- $2 Billion industry
- 116.2 million boxes
- 155,000 bearing acres
- 1500 growers
- Avg orchard 100 acres, some 5000 acres

**only 16 growers/families control 80%*

<6” precipitation annually (half is snow)
Direct sunlight (as opposed to diffuse)
300 days of sunlight each year

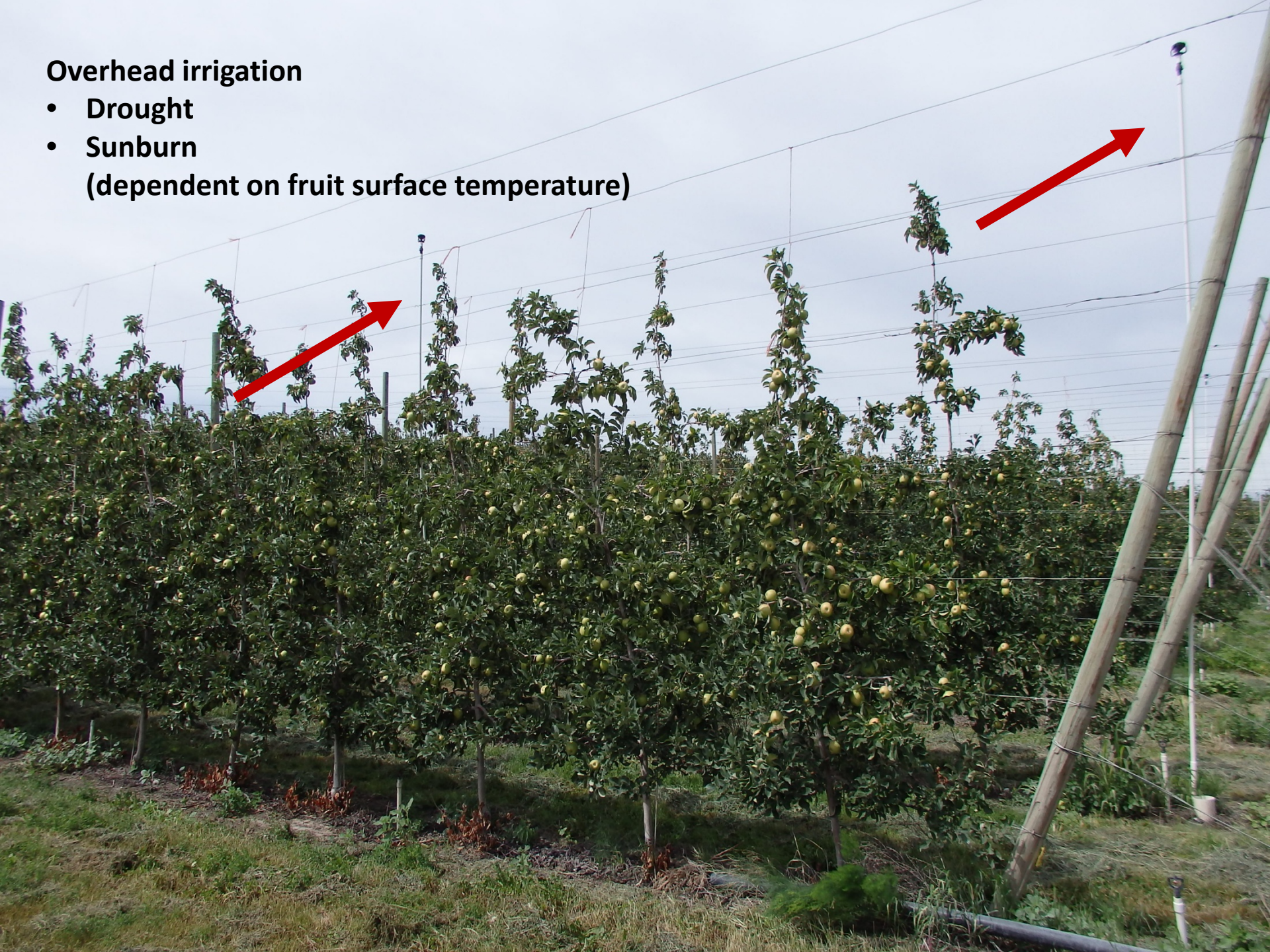
Irrigation: Columbia Basin Project

- 1952 first water received
- Over 670,000 Acres
- Farmers pay by acre based on land classification

Organic Production

- **10% of the industry**
- **Less moisture → significantly less pest pressure**
- **Cultivation for mechanical weed control**

Most orchards are started conventionally, then transitioned to organic


Overhead irrigation
• Drought
• Sunburn
(dependent on fruit surface temperature)

Angled or V-trellis systems

- **Increased sunlight interception**
- **Shades fruit**
- **More productive?**

Engineering problem

Multi-leader systems

14x1.5’
Alternate trees trained to 13° angle
4 leaders per tree

10x1.5’
Alternate trees
2 leaders per tree

Bandit Xpress Checklist

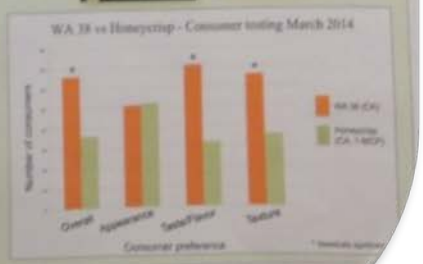
WSU OVERLEY LABORATORY
TREE FRUIT RESEARCH CENTER

Apple Breeding Program

Lisa Brutcher • Bonnie Konishi • Kate Evans

COSMIC CRISP™

Extensive field and post-harvest testing of elites



New approaches for improved phenotyping

Our diversity of germplasm is ideal for validating new technology

Propagation of new selections for phase 2

Acknowledgements: We appreciate the support of the Washington Tree Fruit Research Commission, USDA and WSU

Washing State Apple Production Regions
Western Cascade Plateau & Columbia River Basin

Average Annual Precipitation (in inches)
1961-1990

180.1-200	35.1-40
140.1-180	30.1-35
120.1-140	25.1-30
100.1-120	20.1-25
80.1-100	15.1-20
70.1-80	10.1-15
60.1-70	5.1-10
50.1-60	5 and less
40.1-50	

Wenatchee Research Farm, WSU
East of the Cascade Mountains
Arid climate: Low disease & insect pest pressure
Limited deciduous forest: Reduced diversity of pest ecology
Relatively Flat Terrain: High density, mechanization and automation
Irrigation: Columbia River & tributaries - cheap clean plentiful water
Annual precipitation about 6 inches/yr; 1000 dams for storage

Typical Hudson Valley Orchard

Typical Hudson Valley Orchard

Humid Continental Climate: High disease & insect pest pressure

Deciduous forest borders: High diversity of pest ecology

Sloping Terrain: Difficulty to install high density, mechanization and automation

Irrigation: Pond and well water

Average Rainfall 46.2”/yr.

Key Pests of Washington State Apple

Lepidoptera:

**Codling Moth*

Leafroller

Lesser Appleworm

Lacambia sp.

Eye spotted bud moth

Diptera:

**Apple maggot*

Hemiptera:

Lygus bug

**Stink Bug species*

Campylomma

Box elder bug

Homoptera:

**Rosy Apple aphid*

**San Jose Scale*

Thysanoptera:

Western flower thrips

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Thysanoptera:

Western flower thrips

Green Fruitworm

Plum Curculio

European Apple Sawfly

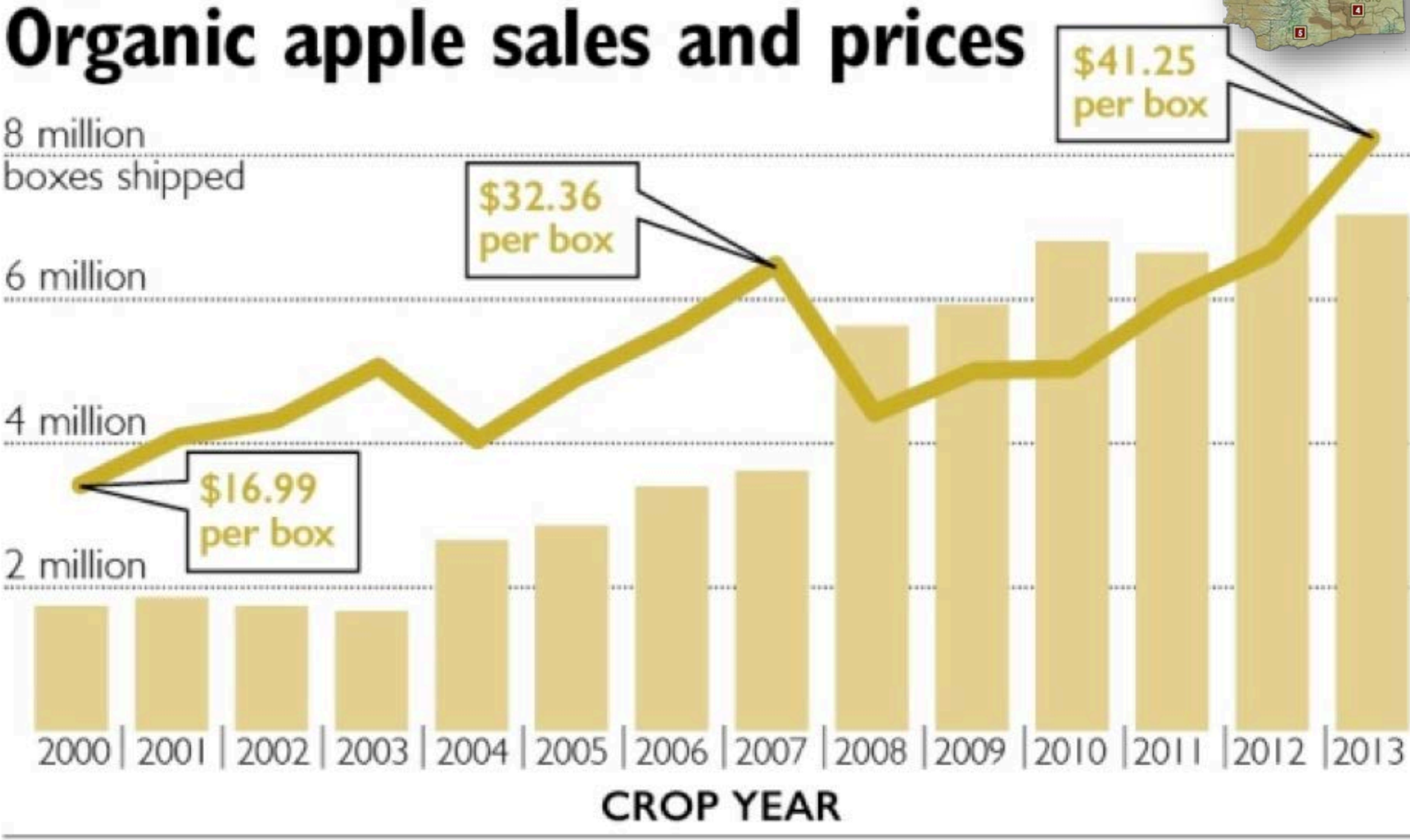
Sunburn - cooling fruit (Surround)

Fruit Size (To Large)

Conducive for Organic Production

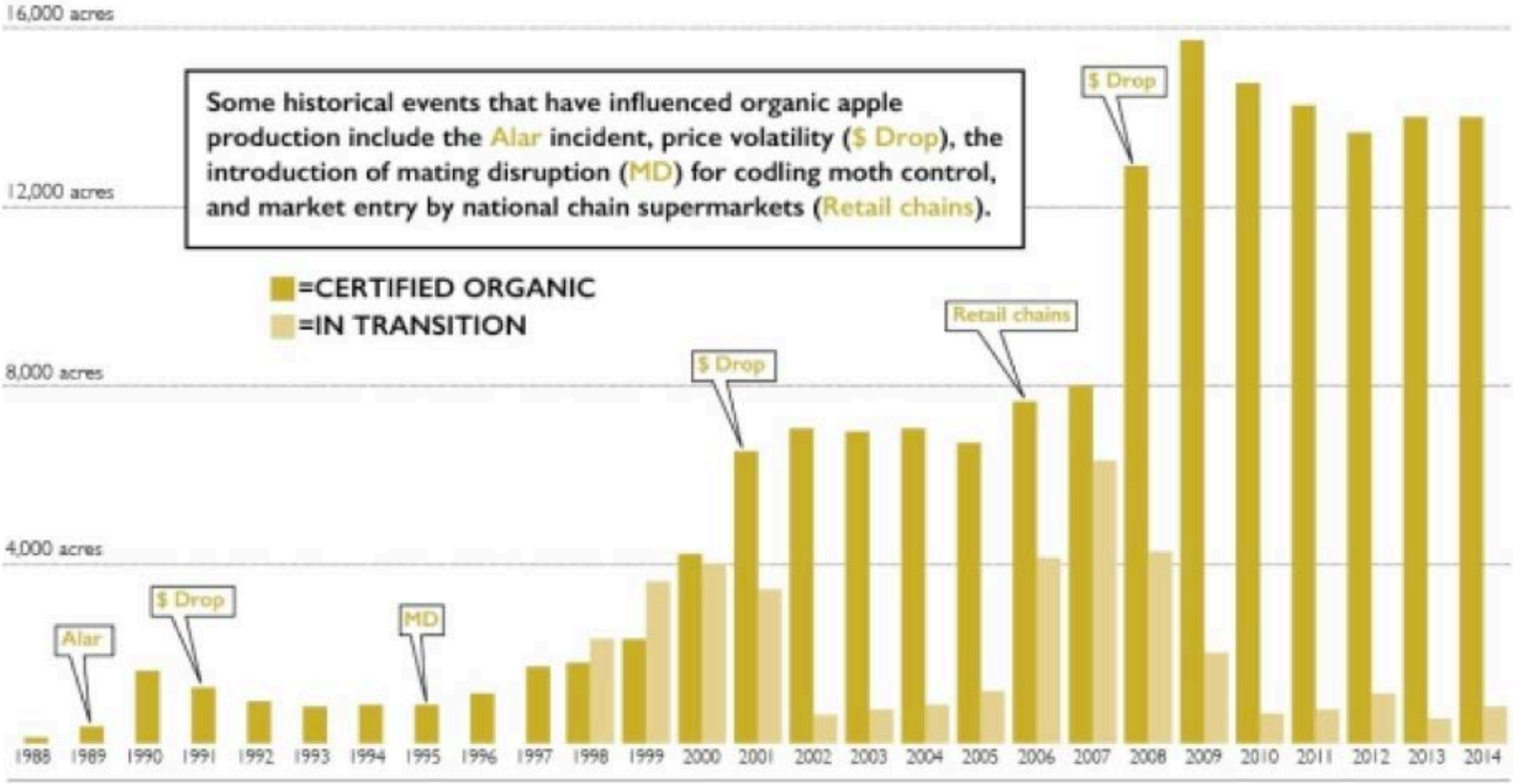
Key Pests of Washington State Apple

Organic apple sales and prices



Key Pests of Washington State Apple

Washington's organic apple acreage



Apple maggot *Rhagoletis pomonella* (Walsh)
(Diptera: Tephritidae)

- The first confirmed apple maggot infestations in the Northwest were in Oregon in 1979.
- Trapping programs have located maggots in western Washington, both sides of the Columbia River Gorge and in Spokane (eastern part of Washington State.

Apple maggot *Rhagoletis pomonella* (Walsh)
(Diptera: Tephritidae)

- In the early 1980s, states in the Pacific Northwest launched programs to control and contain apple maggot.
- The **control / containment** program ended in 1985 when *financial resources* became limited and the apple maggot was found in *native hawthorn* along streams, preventing control by insecticides.

Crataegus douglasii
black hawthorn, Douglas' hawthorn

Apple maggot *Rhagoletis pomonella* (Walsh)
(Diptera: Tephritidae)

- Apple maggot trapping program conducted annually using 5,000 - 8,500 apple maggot traps.
- Trapping results forwarded to county pest boards for control, *suppression*, or *eradication.*
- Counties may be quarantined in whole or in part based on trap catches and other evidence of apple maggot activity detected.

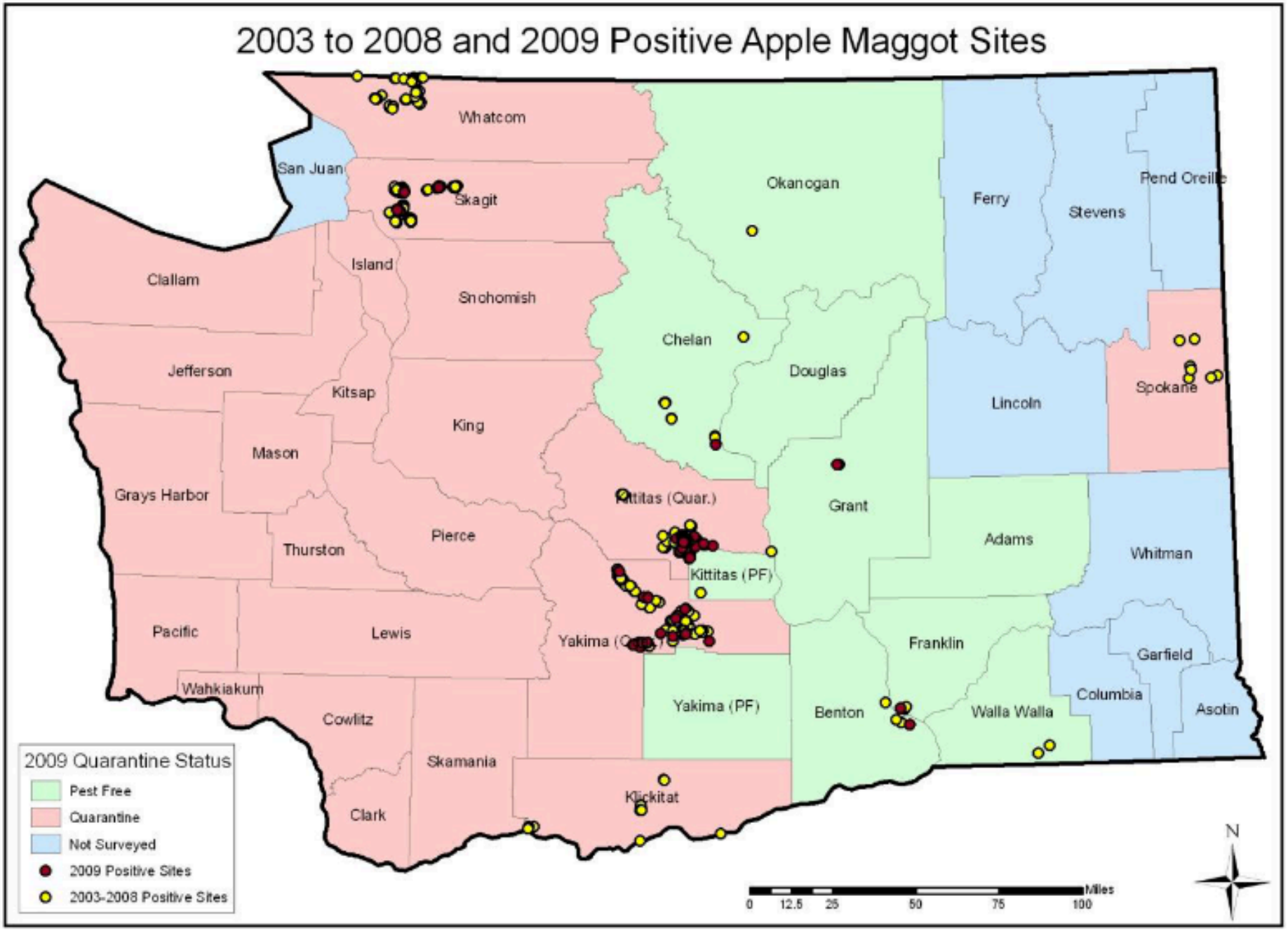
Apple maggot *Rhagoletis pomonella* (Walsh)
(Diptera: Tephritidae)

- **Purpose of apple maggot quarantine:**

Facilitate the movement of commercial fruit to domestic and international markets by providing shippers with one of two types of **WSDA documents certifying** their fruit is apple-maggot free.

- One certificate states no apple maggot flies were caught within a half-mile of the orchard shipping the fruit.

- The other certificate states flies were caught within a half-mile of the orchard, but WSDA inspection revealed no apple maggot larvae in the fruit.

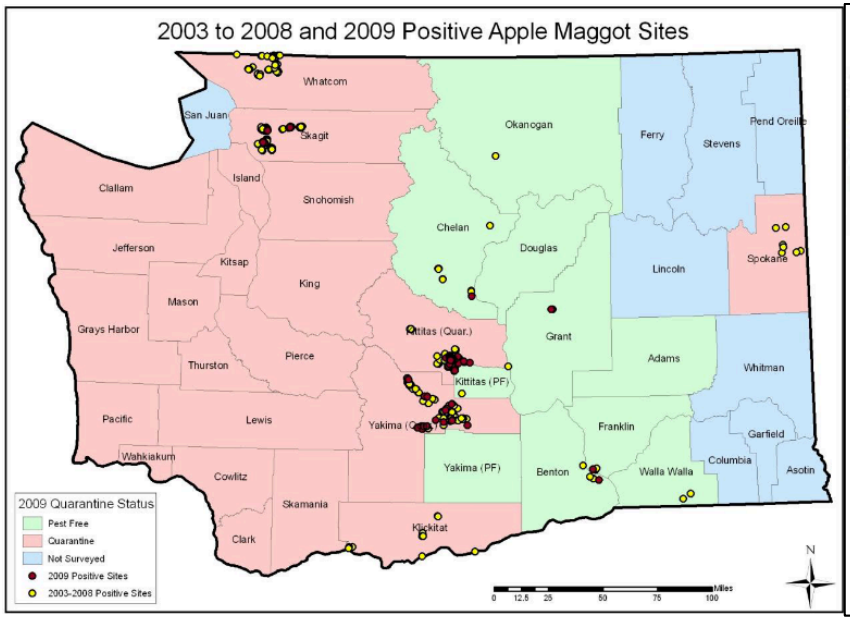

2003 to 2008 and 2009 Positive Apple Maggot Sites
Whatcom
San Juan
Skagit
Okanogan
Ferry
Stevens
Pend Oreille
Island
Clallam
Snohomish
Chelan
Douglas
Lincoln
Spokane
Jefferson
Kitsap
King
Mason
Grays Harbor
Kittitas (Quar.)
Grant
Adams
Whitman
Pierce
Thurston
Kittitas (PF)
Pacific
Lewis
Yakima (Quar.)
Franklin
Garfield
Wahkiakum
Yakima (PF)
Benton
Columbia
Walla Walla
Asotin
Cowlitz
Skamania
Klickitat
Clark
2009 Quarantine Status
Pest Free
Quarantine
Not Surveyed
2009 Positive Sites
2003-2008 Positive Sites
0
12.5
25
50
75
100
Miles
N

Apple maggot *Rhagoletis pomonella* (Walsh)
(Diptera: Tephritidae)

- Central Washington AM populations have increased in 1981–2010 in Kittitas and Yakima Counties.

- However, only 0 to 4.7% of traps on apple, crabapple, and hawthorn trees were positive for flies (commercial apple production region)

Apple Maggot Washington State Survey Summary Report

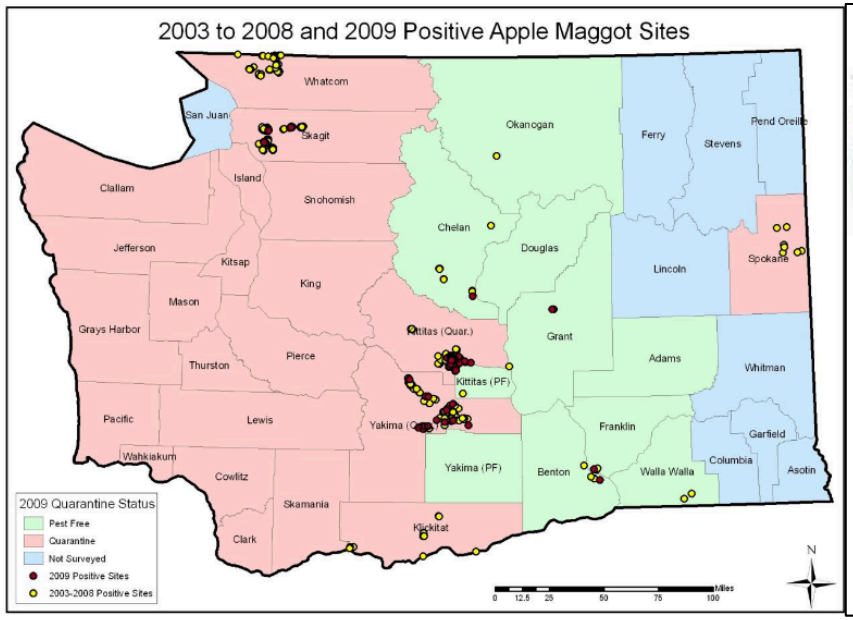


Apple maggot *Rhagoletis pomonella* (Walsh)
(Diptera: Tephritidae)

- While further north in Klickitat County, located farther from commercial apple orchards, 0 to 41.9% of traps were positive.

- Higher populations of Black-fruited hawthorn trees, black hawthorn and Douglas' thornapple (*C. douglasii)* contribute to AM presence.

Apple Maggot Washington State Survey Summary Report



Statistics

Year	Traps Deployed	Number of Positive Sites (Skagit Co.)
2010	141	58
2009	137	18
2008	204	46
2007	310	64
2006	272	63
2005	398	88
2004	367	60
2003	316	22
2002	341	16
2001	441	45
2000	499	51
1999	404	34
1998	499	12
1997	378	18
1996	121	3

- Apple Maggot trap #'s on the increase in northern counties (Data Skagit Co.)

WSFC "Apple maggots have never been found in commercially packed fruit in the state."

Apple maggot *Rhagoletis pomonella* (Walsh)
(Diptera: Tephritidae)

AM Management (Assail, Carbaryl, Pyrethroids)

- Apply control treatments within 7 days of trapping AM fly in the orchard.
- Upon captures repeat treatments in 14 to 21 days.
- Do not treat again until another fly is detected. Fruit inspected by the Washington State Department of Agriculture for certification prior to shipments.

Key Pests of Washington State Apple

Lepidoptera:
Codling Moth

CM Management

- Prior to the synthetic insecticides 25-60% losses from CM.
- Use of chlorinated hydrocarbon resulted in spider mite (McDM, TSSM and ERM spider mite control failure due to resistance.
- Loss of AZN (azinphosmethyl – Guthion) transition to soft insecticide programs: Assail, Delegate, Altacor, Intrepid 2F, Rimon 0.83EC, CM Virus and mating disruption.

Key Pests of Washington State Apple

Lepidoptera:
Codling Moth

Codling moth Area-wide Management Project (CAMP)

- **Mating disruption** (Isomate C+, Isomate CTT, NoMate, CheckMate) at 200 to 400 dispensers/acre.

- **Management-biological (microbial) control**: COMMERCIAL USE codling moth granulosis virus (Carpovirusine, Cyd-X, Virosoft CP4)

Codling Moth Area Wide Mating Disruption
During Adult Emergence

THANK YOU!