1. Going After the Low-Hanging Fruit
2. IPM for Fruit Trees

THE NEW BACKYARD ORCHARD
Cameron Park – November 2, 2017

Chuck Ingels

Farm & Horticulture Advisor

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http://ccag-eh.ucanr.edu/

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Going After the Low-Hanging Fruit: Training Fruit Trees for Production and Ease of Management

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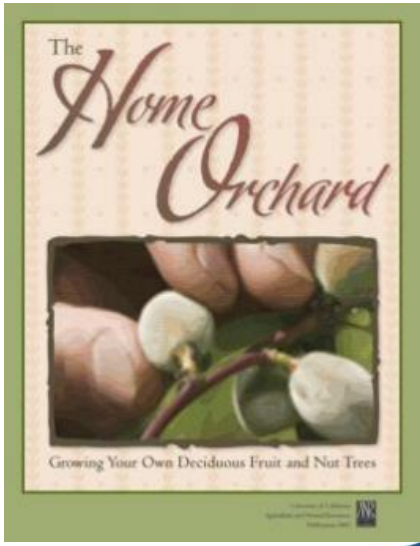

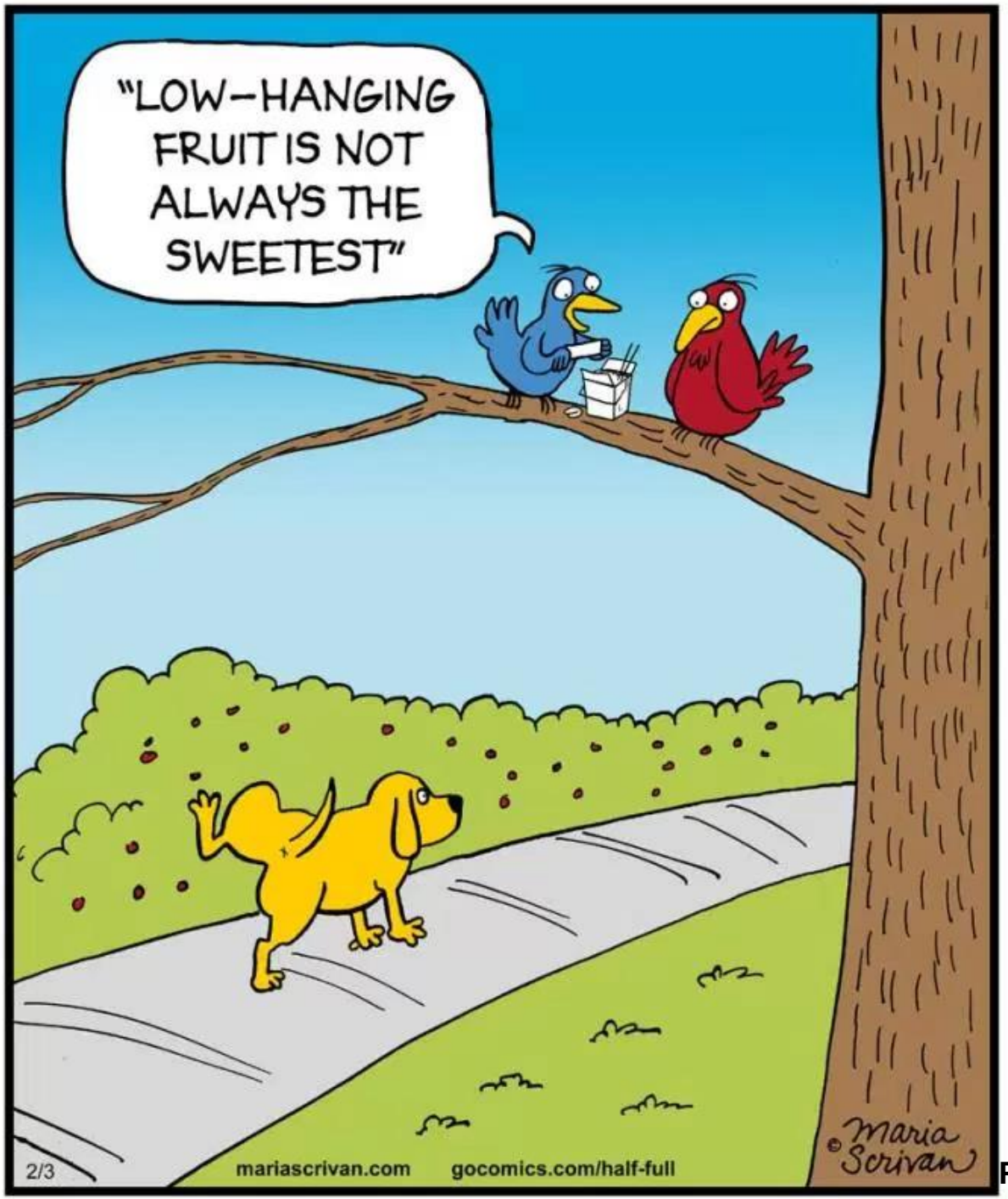

Topics to be Covered

- Benefits & Drawbacks of Keeping Trees Small
- Pruning Overgrown Trees
- Small Trees & Low Fruit
- Fruit Bushes
- Espalier Training

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- **Benefits & Drawbacks of Keeping Trees Small**
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Benefits of Keeping Trees Small

- Easier tree & crop management
- Easier for fruit thinning, pest management
- Little or no ladder work – Safer!

Photo by Mary Flewelling Morris

Excluding Pests Easier with Small Trees

Fair Oaks Horticulture Center

Fruit Shield

Bird Netting

(Avigard)

Fruit bushes (terraced)

Drawbacks of Keeping Trees Small

- Possible lower fruit production per land area
- Deer may feed on lower portion of tree
- Timely summer pruning essential (vacation?)

Deer feeding

Missed summer pruning

Topics to be Covered

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Methods of Reducing Height of Large Trees

1. Cut to desired height in thirds over 3 years
   - Thin upright shoots in summer to provide light for lower fruiting wood

Pruning Overgrown Apple

What else can be done?

Methods of Reducing Height of Large Trees

1. Cut to desired height in thirds over 3 years
   - Thin upright shoots in summer to provide light for lower fruiting wood
2. Bring down height in one year
   - Saw off limbs well below desired height
   - Leave one “nurse” limb to feed roots
   - Thin new shoots, train tree as desired
   - Paint exposed limbs white

Pruning Overgrown Apple – One Year

1999

Pruning Overgrown Apple – One Year

Topics to be Covered

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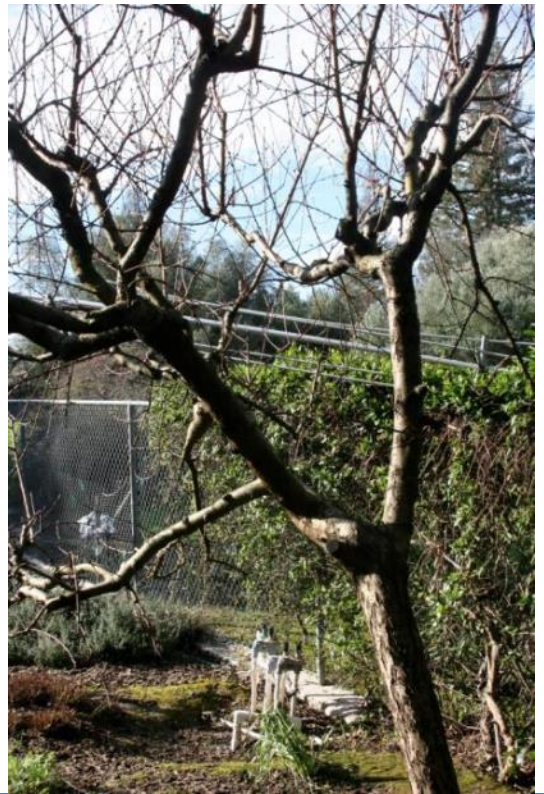
Why Do The Fruit Move Higher Each Year?

Shading!

Peach



Persimmon

Loss of Lower Fruiting Branches

Cutting Back a Fruit Bush

Pluot planted Jan. 1998

Cut back April 2005

Jan. 2006

Feb. 2017

Pluot (2013)

Fruit Bush with Slightly Open Center

Trees in containers should have lower branches

Pruning a Bare-Root Tree

Branches thinner than 3/16

Branches thicker than 3/16

New Shoots on Branches of Newly Planted Tree

Semi-Dwarf vs. Genetic Dwarf

- Standard: 20-25^{+} ft.
- Semi-dwarf (dwarfing rootstock): 12-20 ft.
  - Variable dwarfing
- Genetic dwarf (std. rootstock): 8-12 ft.
  - Available in apricot, apple, olive, peach, nectarine, pomegranate
  - Selection of varieties is limited
  - Not available in citrus (mandarin naturally dwarfing), fig, pear, persimmon, plum/ pluot

INTERNODE LENGTH

Standard Peach

Genetic Dwarf Peach

Summer Pruning of Mature Trees

- Purpose: To increase sunlight & productivity of lower fruiting wood
- Remove unwanted vigorous, upright shoots 1-2 times during season
- Bring down tree height
- Large branches may sunburn if pruning is excessive

Summer Pruning (Plum)

Before

After

Prune Apricots and Cherries in August to Avoid Branch Diseases (Eutypa, others) - Mainly No., Central CA

Topics to be Covered

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- **Fruit Bushes**
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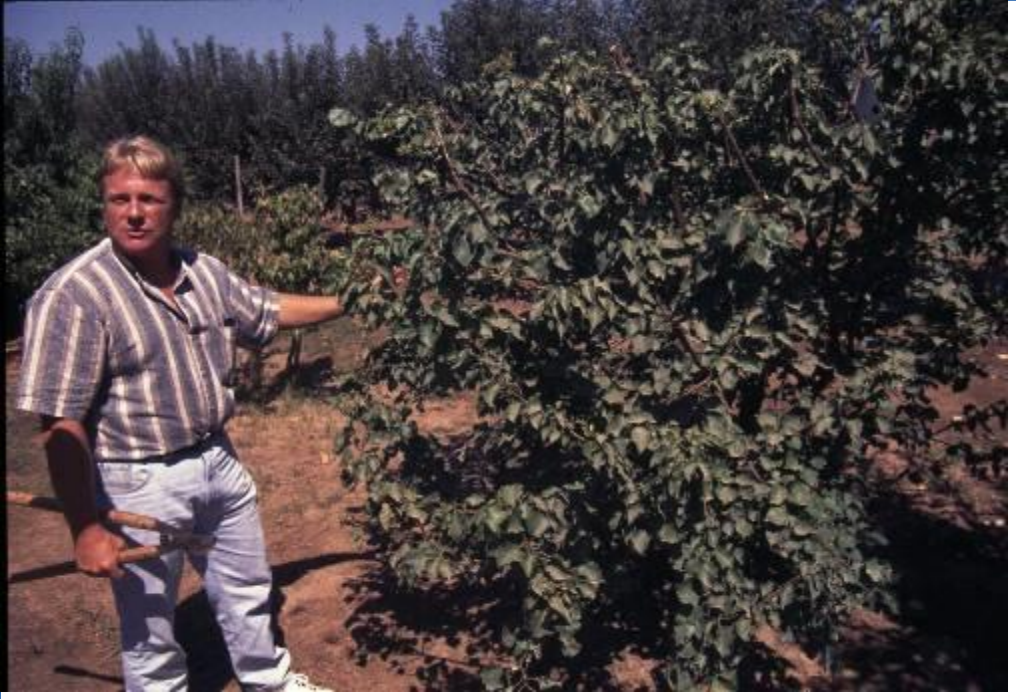
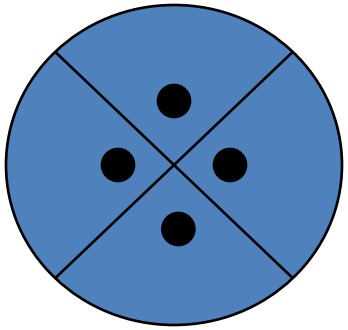


Fruit Bushes Kept at Desired Height

Fruit Bushes

Configuration & Spacing



- 1, 2, 3, or 4 trees per “hole”
  - 2 or 3 trees – 18” apart
  - 4 trees – 24” apart
- 1 tree planted 4-10 ft. apart (std. = 6-8 ft.)
- Group planted 10-12 ft. apart

Fruit Bushes

Pruning – Years 1 & 2

- At planting, head trees to 18-24 in.
- Mid-spring – cut back new growth by half
- Mid-summer – cut subsequent growth back by half
- Thinning cuts for sunlight penetration
- May need to prune 1-2 more times

Cutting New Shoots in Half

Mid-Summer

Fruit Bushes

Pruning Mature Trees

- Cut back new growth above selected tree height 2-3 times during growing season
- Thinning cuts for sunlight penetration

1st (of 2) Fruit Bush Pruning

May 8, 2016

(Photo taken from higher terrace)

Before

After

Fruit Bushes

- Advantages
  - Tree maintenance without ladder
  - Trees for small spaces
  - Sequential ripening
- Disadvantages
  - Less fruit
  - No shade
  - Timing of pruning critical

Key Summer Pruning Missed

Cherry,
Pome Fruits
Ideal for Fruit Bush

Apricot, Plum/Pluot Fruit Bushes

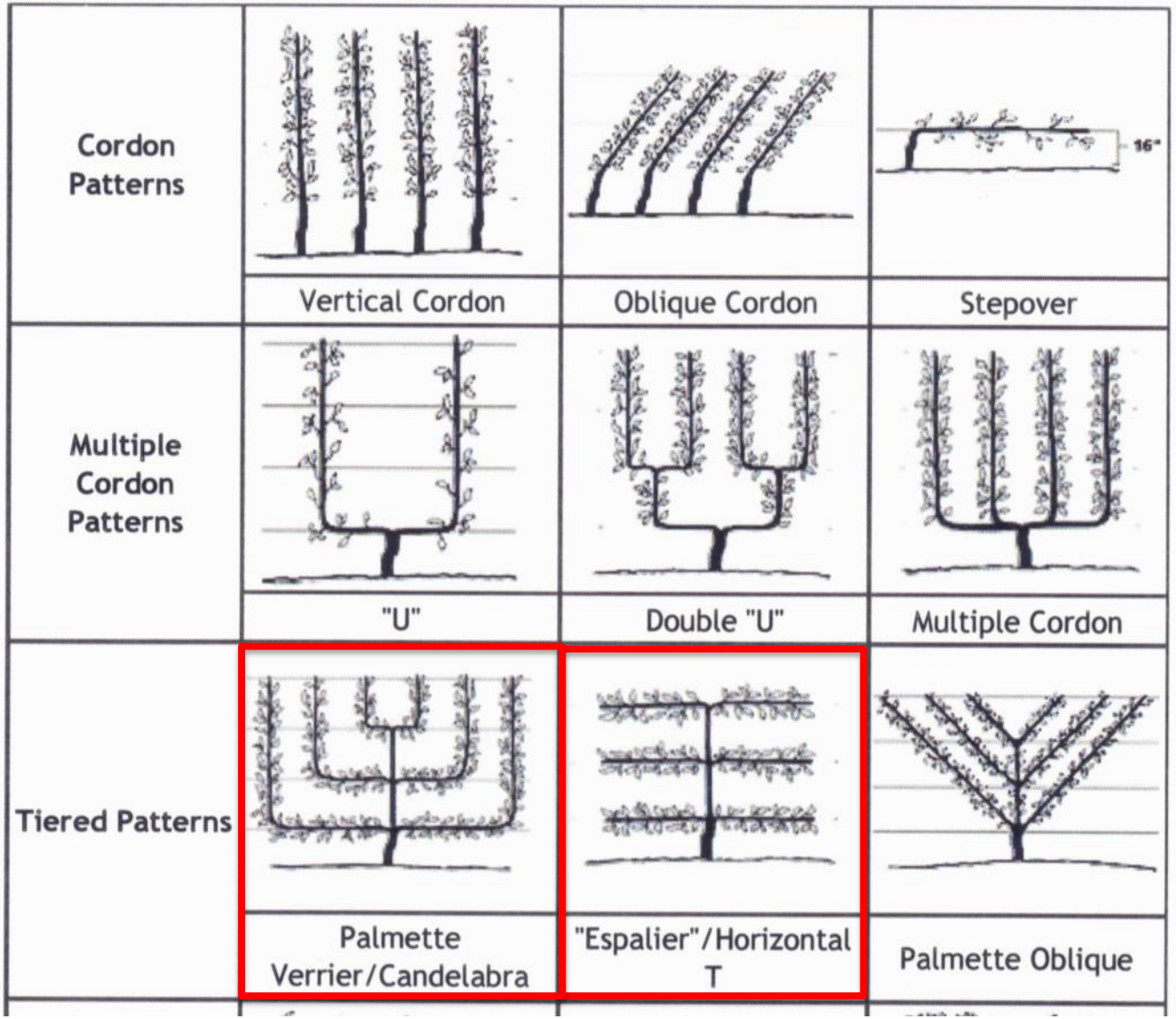
Vigorous Growth – Extra Work

Topics to be Covered

- Benefits & Drawbacks of Keeping Trees Small
- Pruning Overgrown Trees
- Small Trees & Low Fruit
- Fruit Bushes
- **Espalier Training**

Typical Espalier Patterns

Source: EspalierServices.com



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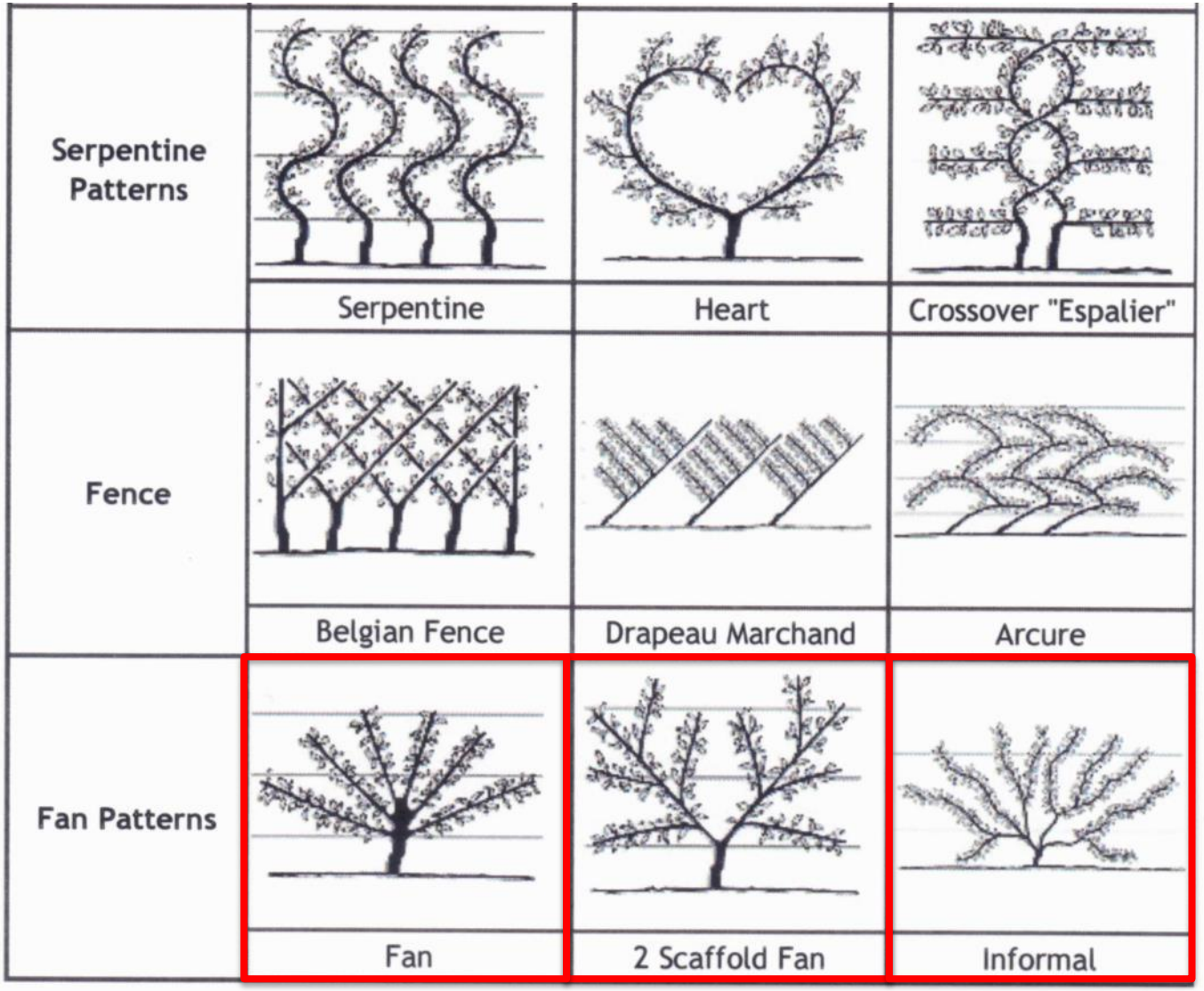


Espalier Training

Advantages

- Good use of narrow spaces
- Efficient crop production
- Heat capture in winter on south-facing walls
- Narrow fruiting wall, good sunlight penetration
- Drip tubing can be raised on wire(s)
- Improved pest management

Two Drip Lines, 18 In. Apart

Flag Emitters 2 Ft. apart

Espalier Training

Disadvantages

- Trellis costs
- Increased time for detailed training and tying
- Lack of knowledge or understanding
- Difficult with fast-growing trees and trees that fruit on long shoots or branches
- Narrow canopy may increase sunburn and branch borers

Espalier Training Examples

Apple Orchards - Washington

Espalier Training Examples

Campovida (Hopland)

Filoli (Woodside)

Stepover Apples (France)

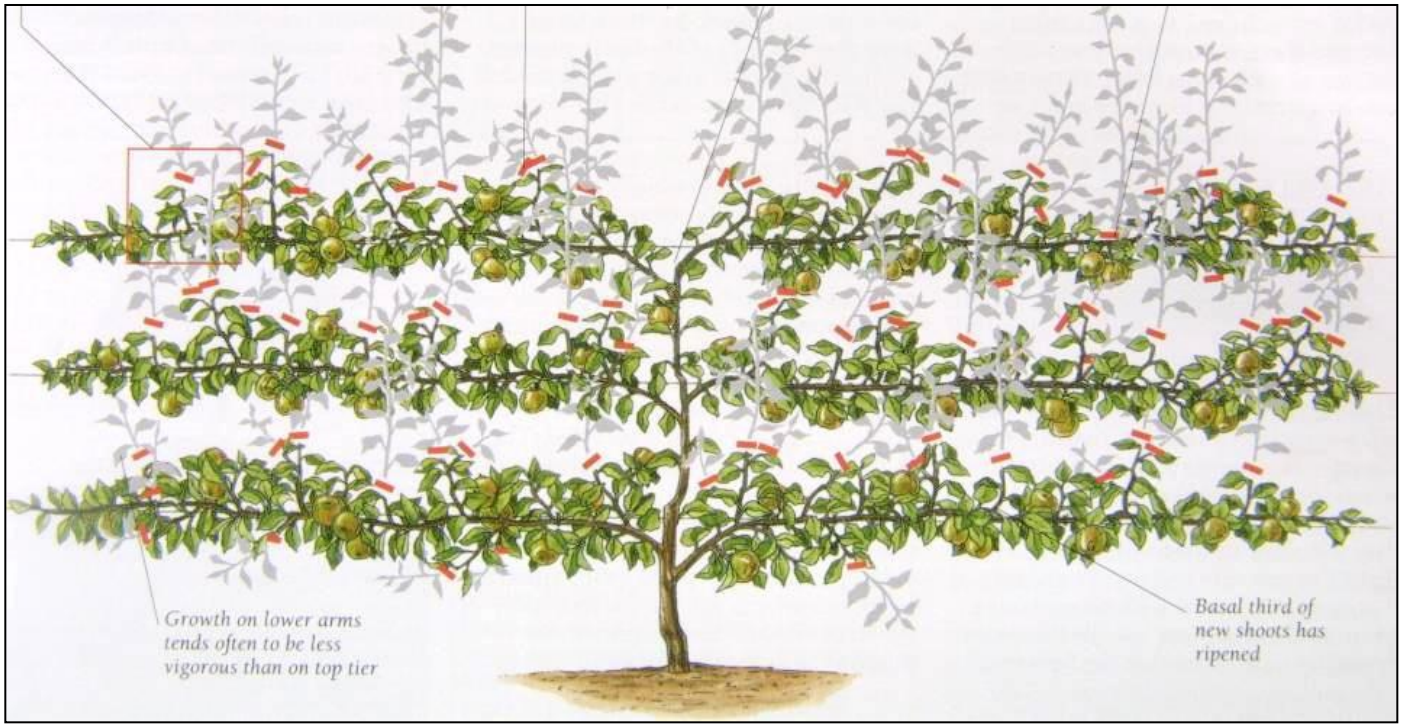
Mandarin Espalier

Horizontal T Espalier

Promote Spurs

Horizontal T Espalier

Growing Season



Source: Pruning and Training (Amer. Hort. Soc.)

Dormant Pruning

Young Espalier

Before

After

Asian Pear Espalier

Palmette Verrier (Candelabra)

Palmette Verrier

Asian Pear: Planted Jan. 2001

April 2002

May 2002

Palmette Verrier

Asian Pear: Planted Jan. 2001

Jan. 2003

March 2004

July 2004

Palmette Verrier

Asian Pear: Planted Jan. 2001

March 2014

Palmette Verrier

Asian Pear: Planted Jan. 2001

Aug. 2016 (South side)

Aug. 2016 (North side)

Palmette Verrier

Asian Pear: Planted Jan. 2001

Cut back 5/2017

Fan Espalier

Cherry – May 2013 (Year 1)

Spreading only – Little or no pruning

Fan Espalier

Cherry – May 2015 (Year 3)

Fan Espalier

Cherry – May 2016 (Year 4)

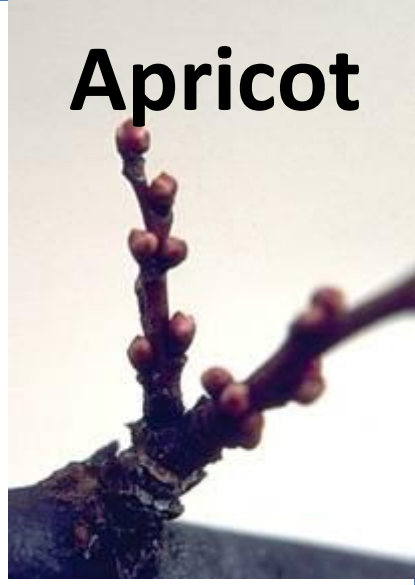
Fan Espalier

Cherry (Year 5)

Nov. 2016

March 2017

Spurs



Peach Fruiting Branches

2-Scaffold Fan Peach

Fair Oaks Hort. Center

Planted Feb. 2013

Peach Espalier

2013

April

June

July

Peach Espalier

2013

July

Nov.

Peach Espalier

(3) May 17, 2014

Dealing with Lateral Shoots

Can’t do this!

Cut to lowest lateral

Peach Espalier

July 12, 2014

Before

After

Flower buds forming (late July)

Year 2 (2014): 66 fruits

Peach Espalier

March 7, 2015

April 11, 2015

Before

After

Peach Espalier

2nd pruning – 5/10/2015

Before and After Pruning

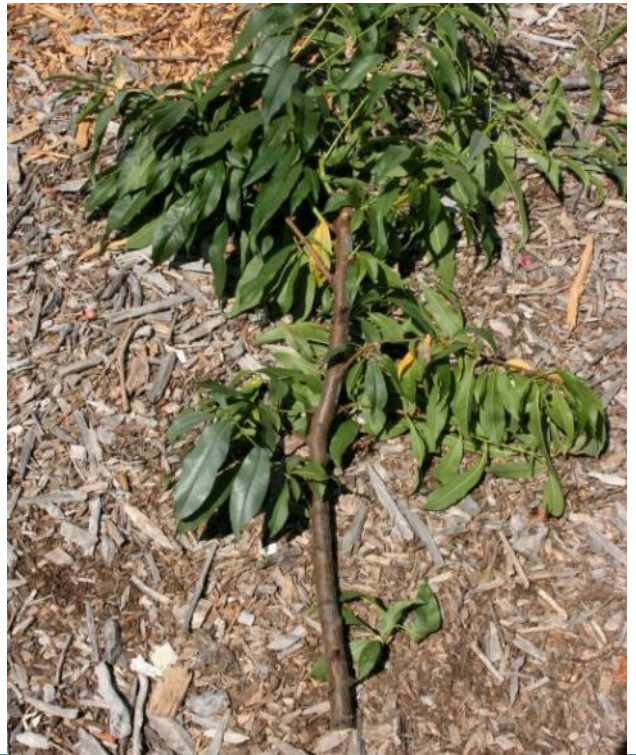
May 2016 (2nd pruning)

Flowering and Fruiting

360 fruits
2016 (year 4)

Postharvest Pruning

8/19/2016



Make the Trellis Big Enough for the Species

Pluot – 6’ tall, 7’ wide
Too small!

Fig – 10’ tall, 20’ wide
About right.

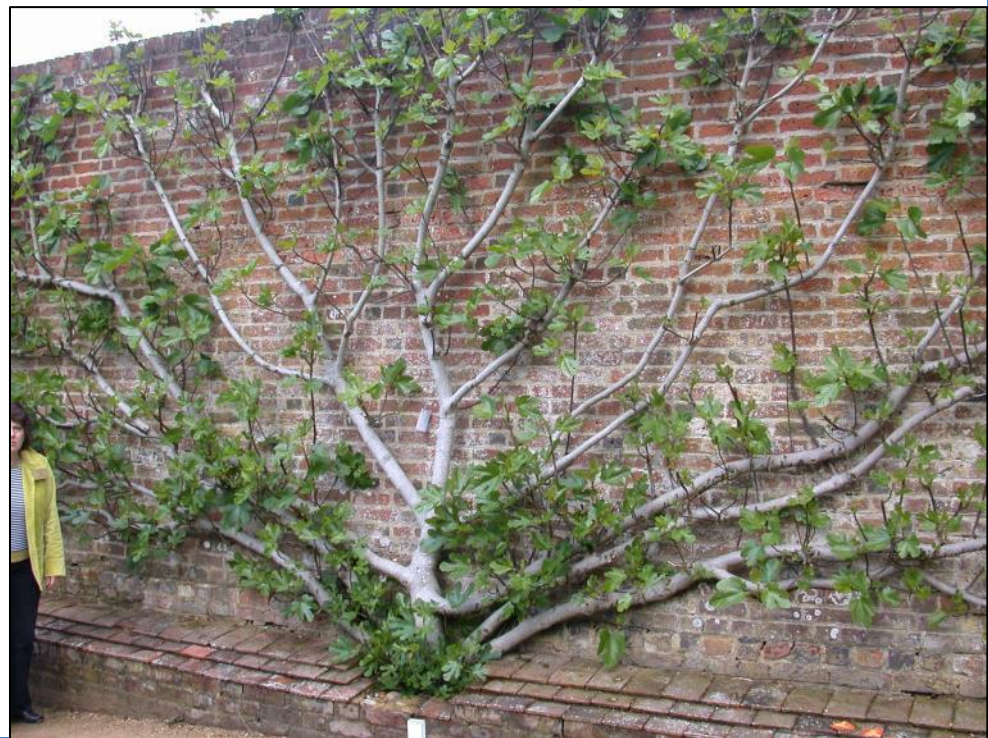


Photo by
Pam Geisel

Wood Post Trellis

Anchoring End Post

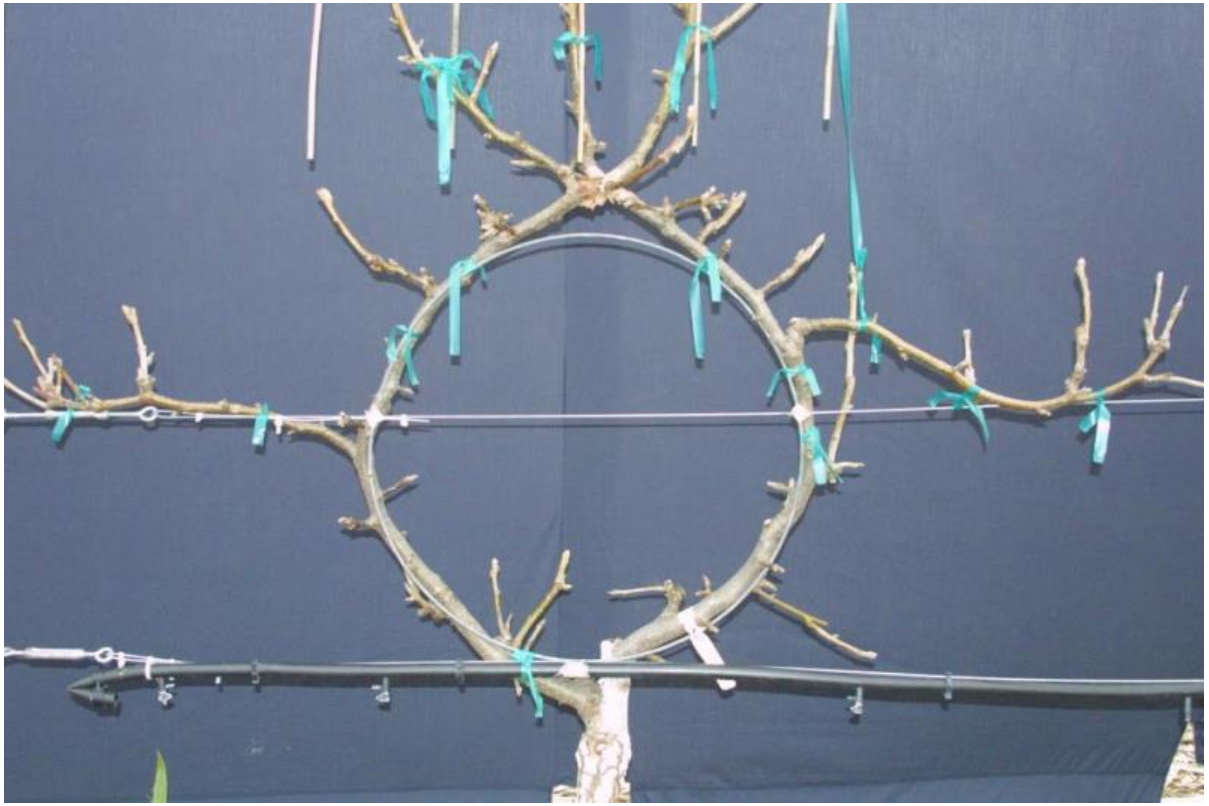
Earth Anchors

Metal Post Trellis

Plant Tie Bands (Rubber)

Ideal for training shoots on trellis

Questions?



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Integrated Pest Management for Fruit Trees

General Considerations

- Use resistant species and varieties
- Use appropriate training & pruning
  - Keep trees small for easier management
- Keep sprinkler water off trees
- The best thing to apply is your shadow
- Spray as a last resort, use organic/least toxic products (my emphasis in this talk)

Topics to be Covered

- Insects
  - Codling moth
  - Aphids and Scale
- Diseases
  - Peach leaf curl
  - Fire blight
  - Brown Rot
  - Gummosis and canker diseases

Topics to be Covered

- **Insects**
  - **Codling moth**
  - Aphids and Scale
- Diseases
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Codling Moth

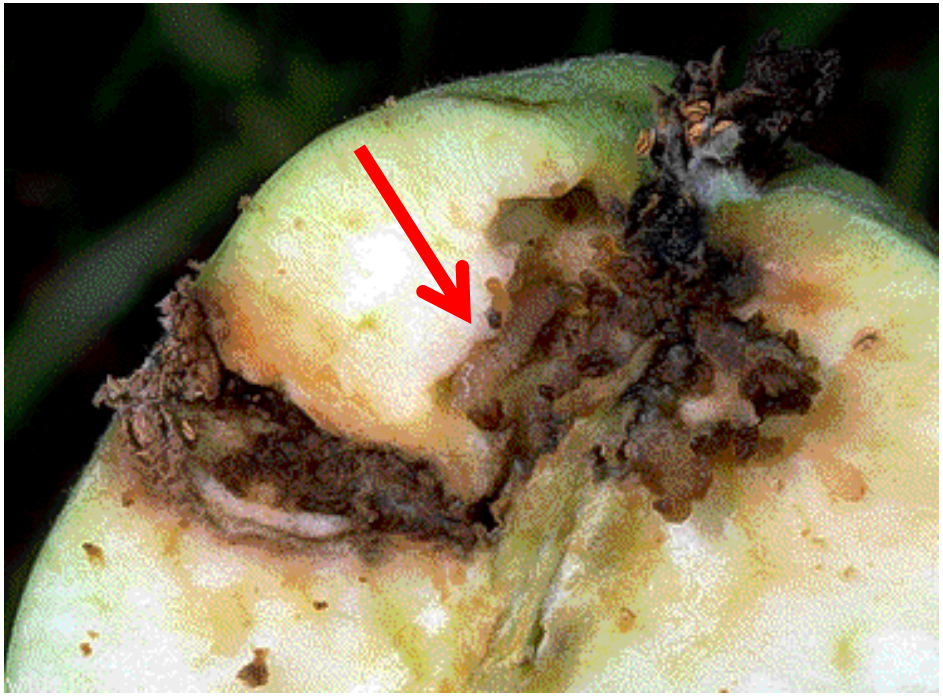
Cydia pomenella

Codling Moth

Eggs and newly hatched larva

Pupating larvae

Codling Moth



Codling Moth

Characteristics

- Pest of apple, pear, quince, walnut
- Overwinters as larva in cocoon
- Mating begins during or just after flowering (temp. dependent)
- 1-4 generations per year
- Extremely difficult to control

Codling Moth

Selected Control Methods

- Take what you get, cut damage out
- Remove/destroy infested fruit early
- Footies (nylon)
  - Time consuming, not great control
- Mass trapping of:
  - Males (pheromone traps)
  - Males & females (vinegar/molasses solution)
- Organic products: Hort. oil, granulosis virus (Cyd-X), spinosad, kaolin clay (Surround)
  - Good coverage is essential

Mass Trapping

But Does it Work?

- Catches males & females (and many other insect species)
- Solution:
  - 1 c cider vinegar
  - 1/3 c dark molasses
  - 1/8 tsp ammonia
  - Water to make 1.5 qts.
- Place high in tree – 2/3 of the moths are in the upper 1/3 of the tree
- Mixed results; some people swear by it

Footies

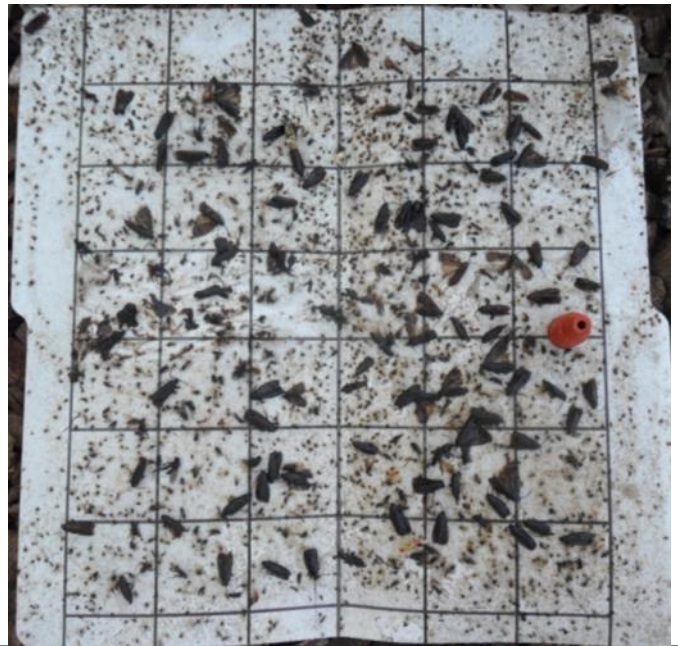
Photo: Espaliers & Backyard Fruit Production

Photo: Urban Farm Hub

Photo: Northwest Edible Life

Codling Moth Phenology Model

- Used by growers, complicated for gardeners
- Trapping to establish biofix date
- Check traps 1-2 times a week until biofix is set, weekly thereafter
- 1st Biofix = The first date that moths are consistently found in traps and sunset temperatures have reached 62° F



Pheromone Traps

Place High in Tree

Not a Control Method

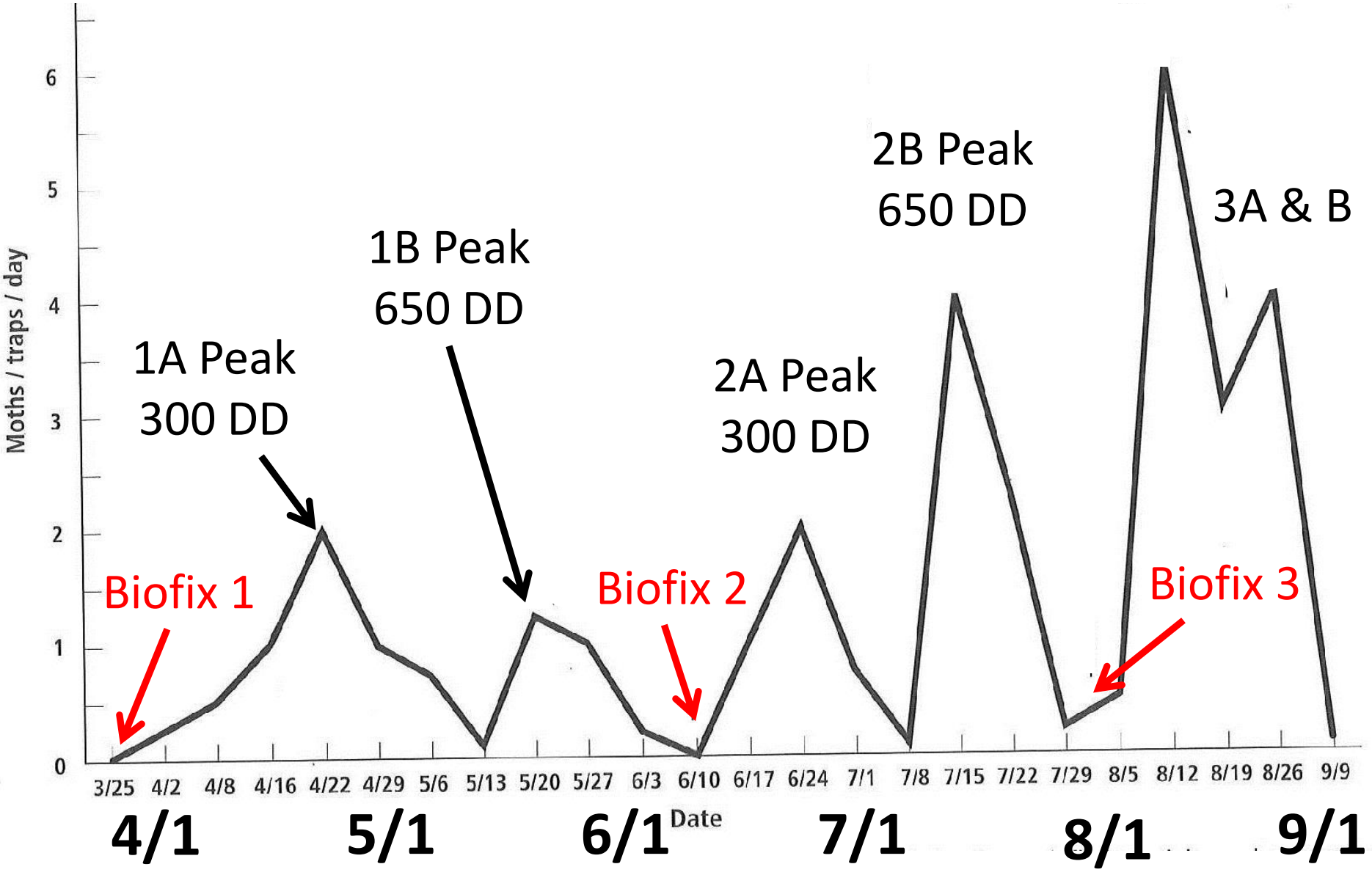
Codling Moth Degree-Day Model

Codling Moth Degree-Day Model

Spray Timing

- 1st Spray: 250 to 300 DD after biofix (egg hatch)
- 2nd Spray: If significant moth catches continue after the first treatment, 650 DD for the second peak of the first generation
- Low trap catches – delay treatment

Typical CM Flight Pattern (Central Valley)



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  - Codling moth
  - **Aphids and Scale**
- Diseases
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  - Fire blight
  - Brown Rot
  - Gummosis and canker diseases

Aphids on Plum

Egg near dormant bud

Managing Aphids

Cultural Control Methods

- Monitor foliage in early spring
- Promote natural enemies
  - Avoid broad spectrum insecticides
  - Provide pollen & nectar sources
- When localized, cut off infested shoots
- Avoid high N fertilization
- Forceful spray of water
- Use tanglefoot to control ants

Managing Aphids

Chemical Control Methods

- In-season: Insecticidal soaps and oils
  - Soap + pyrethrum formulations slightly better
  - Petroleum-based or plant-derived (neem, canola)
  - Early season, before leaves curl
  - Thorough coverage essential, repeat sprays
- Bud swell: Horticultural oil
  - Partial control
- Avoid broad-spectrum insecticides

Natural Enemies

Predators

Natural Enemies

Parasitoids

Parasitized aphids

Topics to be Covered

- **Insects**
  - Codling moth
  - Scale insects
  - Borers
  - **Woolly apple aphid**
  - BMSB
- Keeping Trees Small
  - Fruit bushes
  - Espalier
- Diseases
  - Peach leaf curl
  - Fire blight
  - Gummosis and canker diseases
- At end, not in talk:
  - Aphids
  - Apple & pear scab
  - Brown rot

Woolly Apple Aphid

Branch gall

Root galls

Wooly Apple Aphids

Eriosoma lanigerum

- Feed mainly on bark
- Become active in March & April
- Found on spurs & branches spring, early summer, especially around pruning wounds
- Nymphs move up & down trunk in summer, fall
- Move to roots in winter
- Less problematic on sandy soils

Woolly Apple Aphid

Resistant rootstocks?
- M111, M106

Natural enemies
- Predators & parasitoids
- Promote earwigs with rolled cardboard

Soap or oil sprays (3x):
- Delayed dormant, petal fall, summer

Soft Scale

No Covering – Shell is Female Body

Lecanium scale

Kuno Scale

(*Eulecanium kunoense*)

(Mainly Northern Calif.)

Females in Winter

Females in Spring

Kuno Scale

Eggs in late May

Photo by Joyce Gross

Nymphs in June

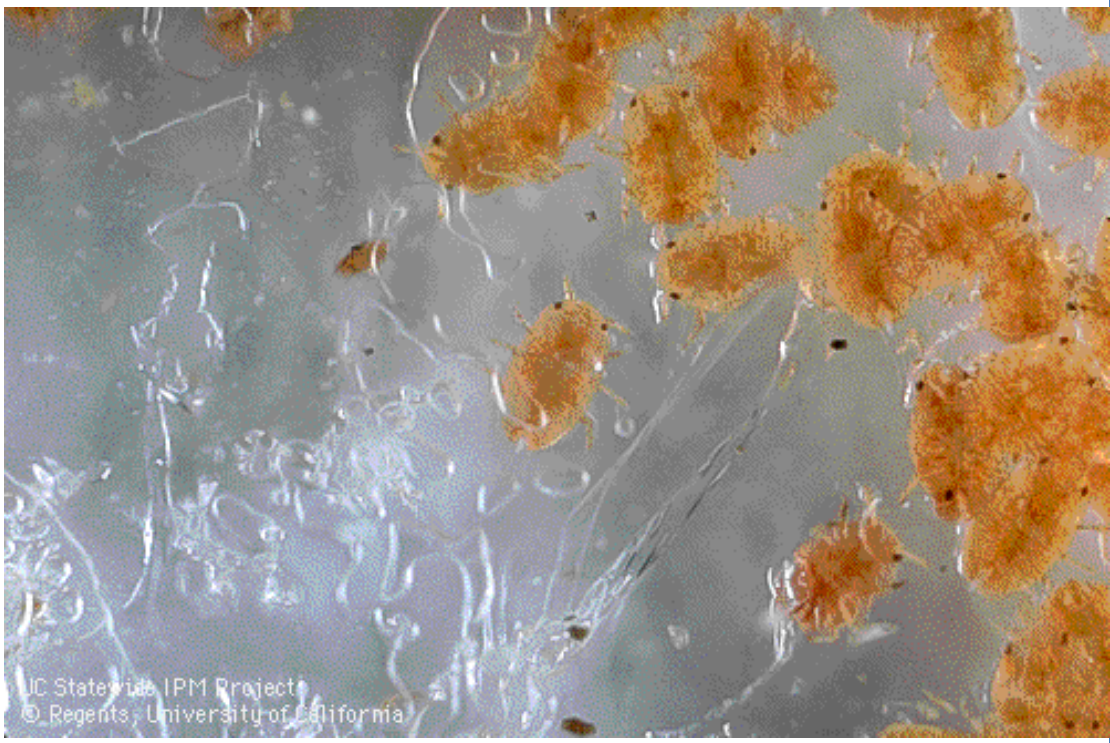
Scale Insects

Characteristics

- Soft scale
  - Lecanium, brown, black, kuno, etc.
  - Covering is body of adult female
  - Excrete honeydew
- Armored scale
  - San Jose, red, etc.
  - Waxy covering over adult
  - No honeydew
- Cottony cushion scale

Double Sided Sticky Tape

Late Spring - Crawler timing for oil spray



Scale Insects

Control Methods

- Tanglefoot to prevent ants (soft scale)
- Promote natural enemies
  - Avoid broad spectrum insecticides
  - Provide pollen & nectar sources
- Dormant spray – Horticultural oil
- Monitor crawlers with sticky tape (May)
- Spray oil after crawlers emerge (early June)
  - But foliage hinders good coverage

Management of Aphids and Soft Scale

Exclude ants with Tanglefoot

–They protect scales from parasitoids

Topics to be Covered

- Insects
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  - Aphids and Scale
- **Diseases**
  - **Peach leaf curl**
  - Fire blight
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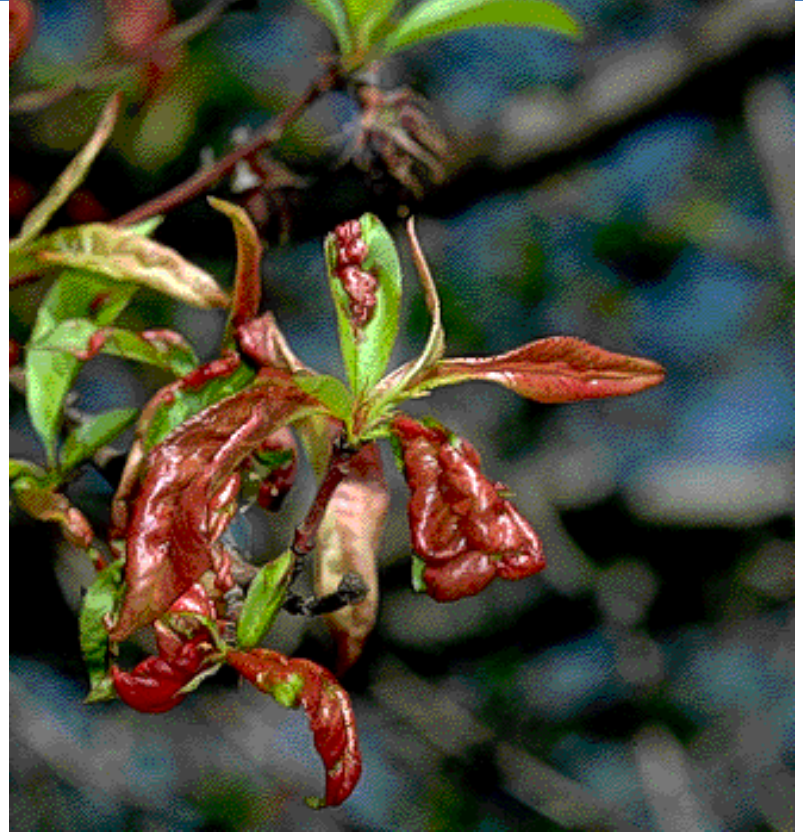
Peach Leaf Curl



Peach Leaf Curl

- Affects peaches, nectarines
- Fungal spores spread by rain, wind
- Spores overwinter in buds and tree surfaces

Control of Peach Leaf Curl

- Lime sulfur, Microcop no longer available
- Copper sprays
  - Tribasic or basic copper sulfate (hard to find)
  - Copper ammonium complex (e.g., Liqui-Cop)
  - Copper soap (e.g., Concern)

  1. Early Dec.
  2. In late winter, a bud swell
- Consider covering trees

Available Copper Products

Selected Brand Names (in CA)

?

Liquid copper (copper ammonium complex)

Copper soap (liquid!) (copper octanoate)

2013 Research Project

Individual Branches Treated

Sprayed branches

Agribon on branch

Untreated

Lime sulfur & Microcop

2012 Peach Leaf Curl Trial

Conclusions

- Very effective:
  - Lime sulfur / Microcop
  - Agribon + Liquicop
- Somewhat less effective:
  - Copper soap, Liquicop, and Agribon
  - But still provided 60-80% control

Best Delayed Dormant Peach Leaf Curl Spray Timing

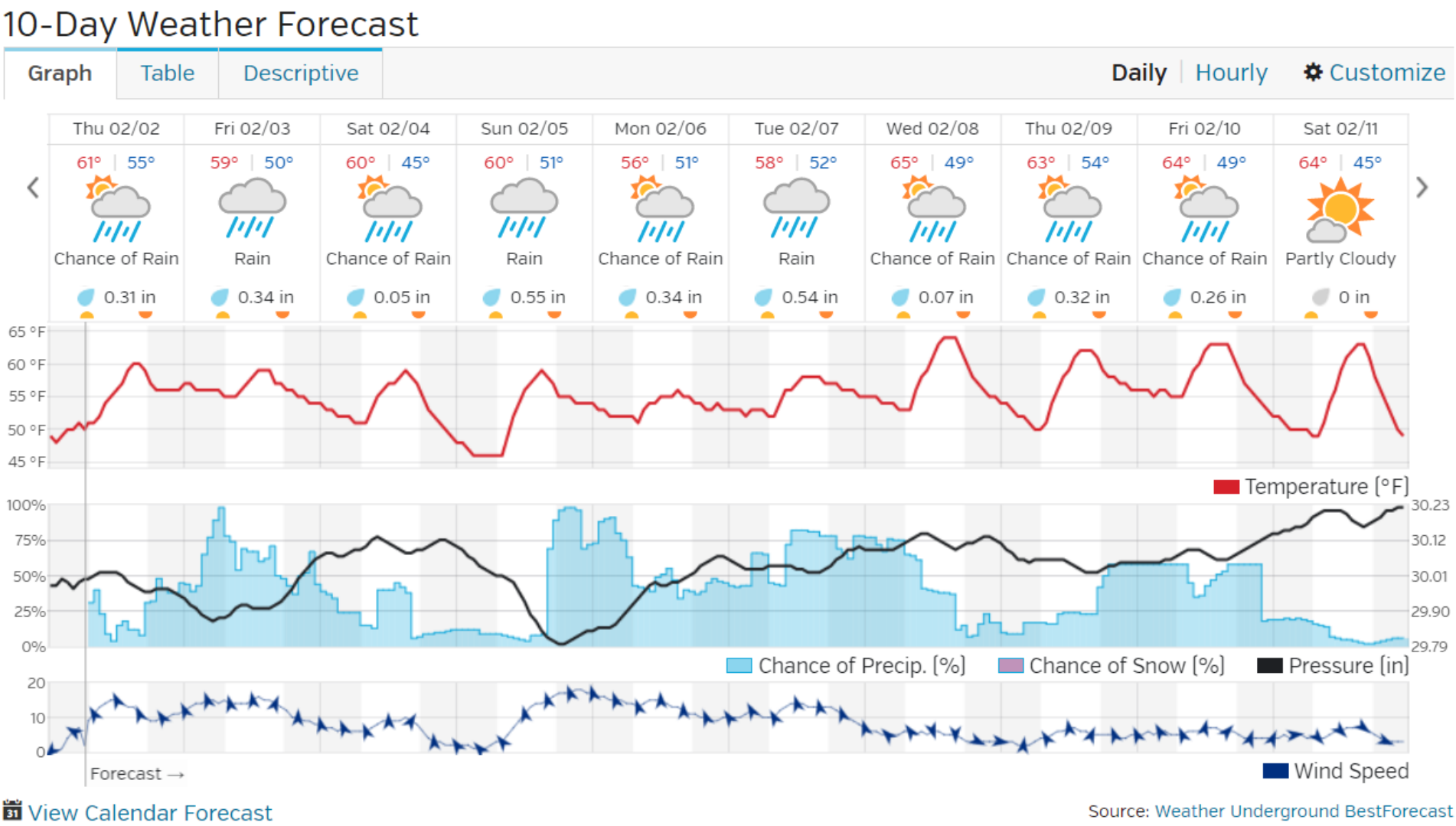
Dormant

First swell

Green tip

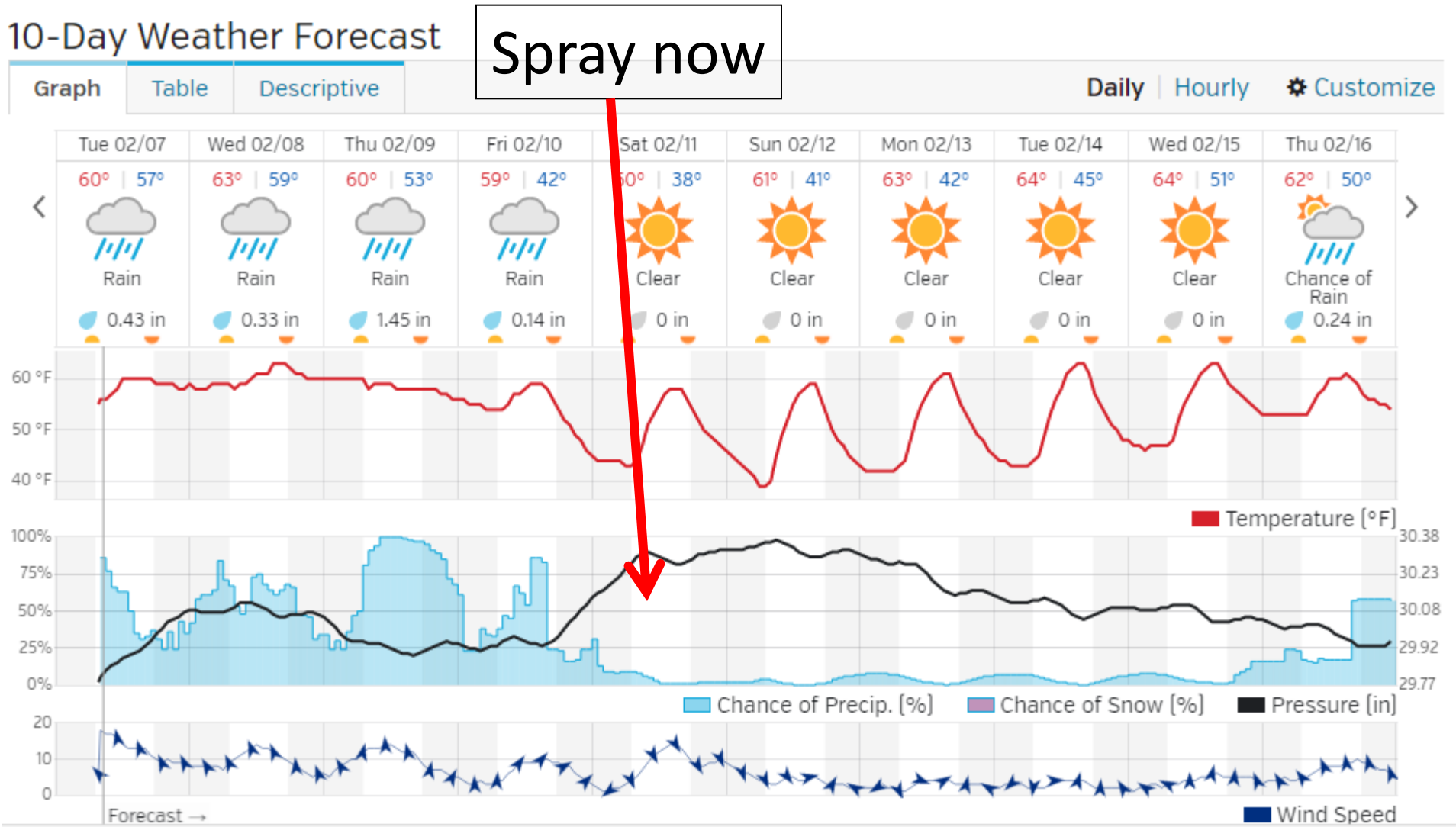
Peach Leaf Curl

Why to Also Spray in Fall



Peach Leaf Curl

Why to Also Spray in Fall



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- Insects
  - Codling moth
  - Aphids and Scale
- **Diseases**
  - Peach leaf curl
  - **Fire blight**
  - Brown Rot
  - Gummosis and canker diseases

Fire Blight

Erwinia amylovora

Fire Blight

Characteristics

- Bacteria – enters through flowers under warm, moist conditions
- Affects apple, pear (esp. Bartlett), Asian pear, flowering pear, quince, loquat, pyracantha, hawthorne
- Bacterial smell (sweet)

Fire Blight

Control Methods

- Plant resistant varieties
- Cut back to lateral branch, 12 in. below infection
  - Sterilize shears between cuts (20% bleach)
    - Soak for 1 min. or spray = more effective than dip
    - Lysol or Pine Sol also work; not rubbing alcohol
  - More important than steriliz.: avoid “short cuts”
- Spray copper twice – early bloom & full bloom

See: http://calag.ucanr.edu/Archive/?article=ca.v045n04p21

Scraping Bark

(Followed by bleach spray)

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- Insects
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  - Aphids and Scale
- **Diseases**
  - Peach leaf curl
  - Fire blight
  - **Brown Rot**
  - Gummosis and canker diseases

Brown Rot

Monolinia spp.

Flower and
Twig Infections

Brown Rot

Monolinia spp.

Fruit Infections

Mummy

Brown Rot

Control Methods for Stone Fruits & Almonds

- Plant resistant varieties, if available
- Fruit thinning, pruning for air circulation
- Remove infected fruit, pick all fruit when ripe, remove mummies and infected twigs
- Keep sprinkler water off trees
- If infections were serious, consider spraying copper starting at pink bud

Topics to be Covered

- Insects
  - Codling moth
  - Aphids and Scale
- **Diseases**
  - Peach leaf curl
  - Fire blight
  - Brown Rot
  - **Gummosis and canker diseases**

Gummosis

Gummosis ("oozing"): The production & exudation of gum by a diseased or damaged tree

- Can result from environmental stress, mechanical injury, disease, or insect infestation
- Oozes mainly spring (soft), hardens in summer, may disappear with fall rains

Bacterial Blast

Pseudomonas syringae

Bacterial Canker

Pseudomonas syringae

Bacterial Canker

Red flecks early on;
Shallow canker

Bacterial Canker

Solutions

Choose less susc. rootstock (Maheleb>Colt>Mazzard)

Summer prune only

Cover tree if frost during bloom

Avoid watering trunk/branches

Proper N fertilization

Cytospora Canker

Fungus enters through injuries, cuts, & buds

Infections occur winter, fall, early spring

Summer prune only

Remove branch 4+” below canker margin

Leave no stubs

Canker surgery

Sources: Utah State Univ.
Penn. State Univ. Extension

Eutypa, Botryosphaeria

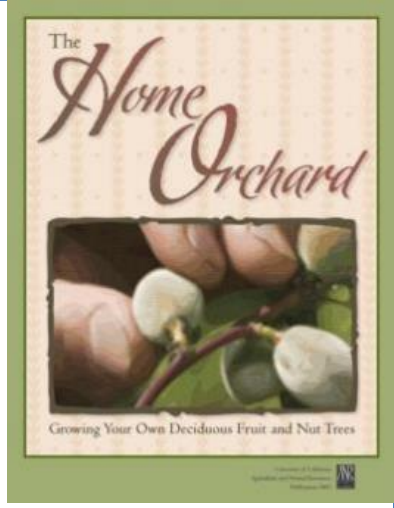
Prune Apricots and Cherries in August

Preventing Canker Diseases

- Prevent trunk damage
- Summer pruning (CA); prevent winter injuries
- Large winter cuts - leave stump, remove in spring
- Keep trees healthy - adequate water, fertilizer
- Prevent insect boring damage
  - Paint south & west-exposed branches white <u>before</u> damage occurs

Questions?

http://ccag-eh.ucanr.edu



- For more information:
- The Home Orchard… (UC publication 3485) (http://anrcatalog.ucanr.edu/Details.aspx?itemNo=3485)
- UC Integrated Pest Management Program (http://ipm.ucanr.edu/)
- Managing diseases and insects in home orchards (https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec631_0.pdf)
- Organic pest and disease management in home fruit trees and berry bushes (http://extension.wsu.edu/publications/wp-content/uploads/sites/54/publications/em066e.pdf)
- Fair Oaks Horticulture Center (http://sacmg.ucanr.edu/Fair_Oaks_Horticulture_Center/)