

**Paul Vossen**  
**University of California**  
**Cooperative Extension**  
**Farm Advisor**

# BERRIES





# Retiring after 36 years (6-2016)

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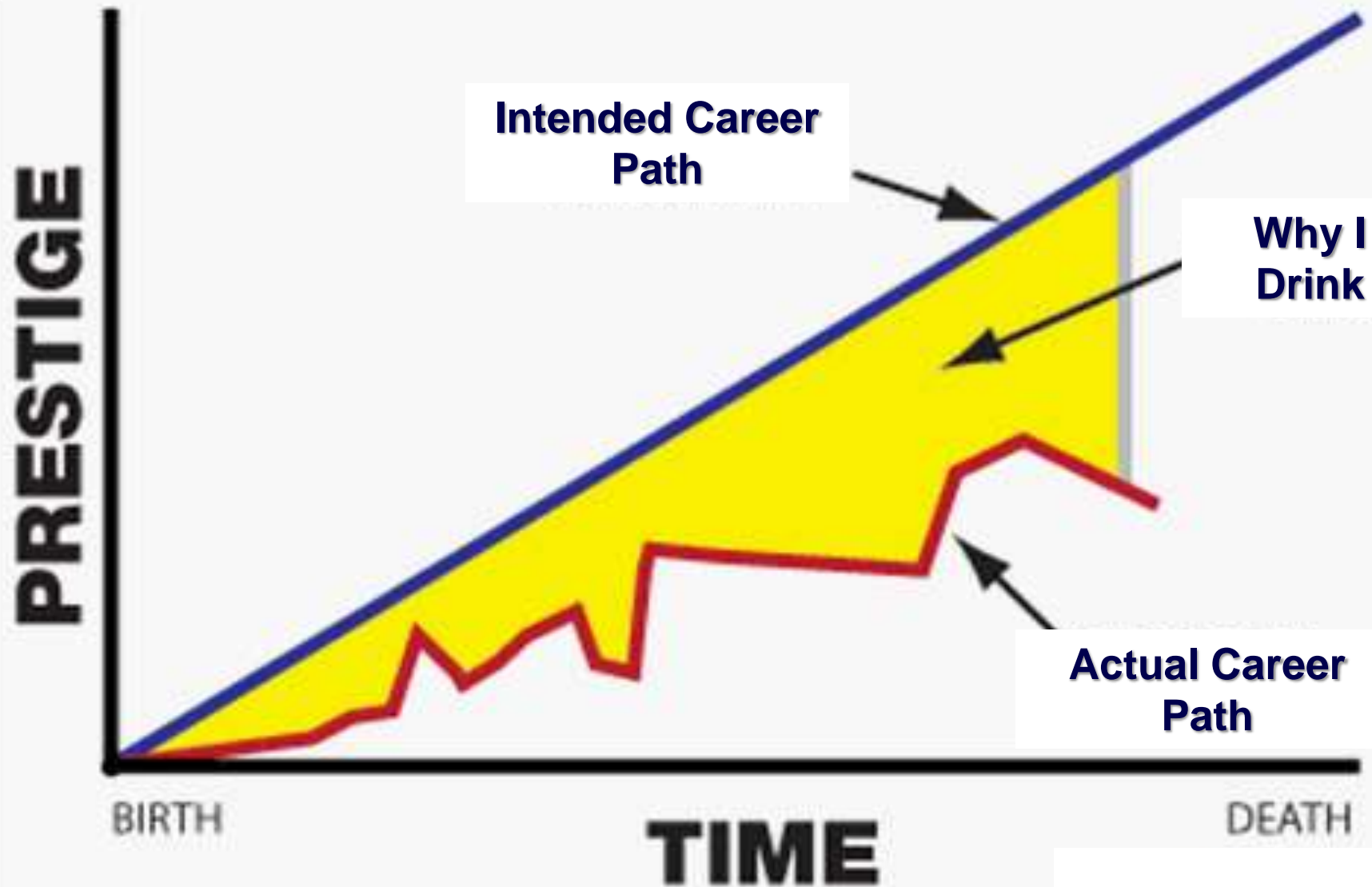




# No more of this!



# Factoids – Life of P. Vossen





# Head in the Clouds



**University of California**

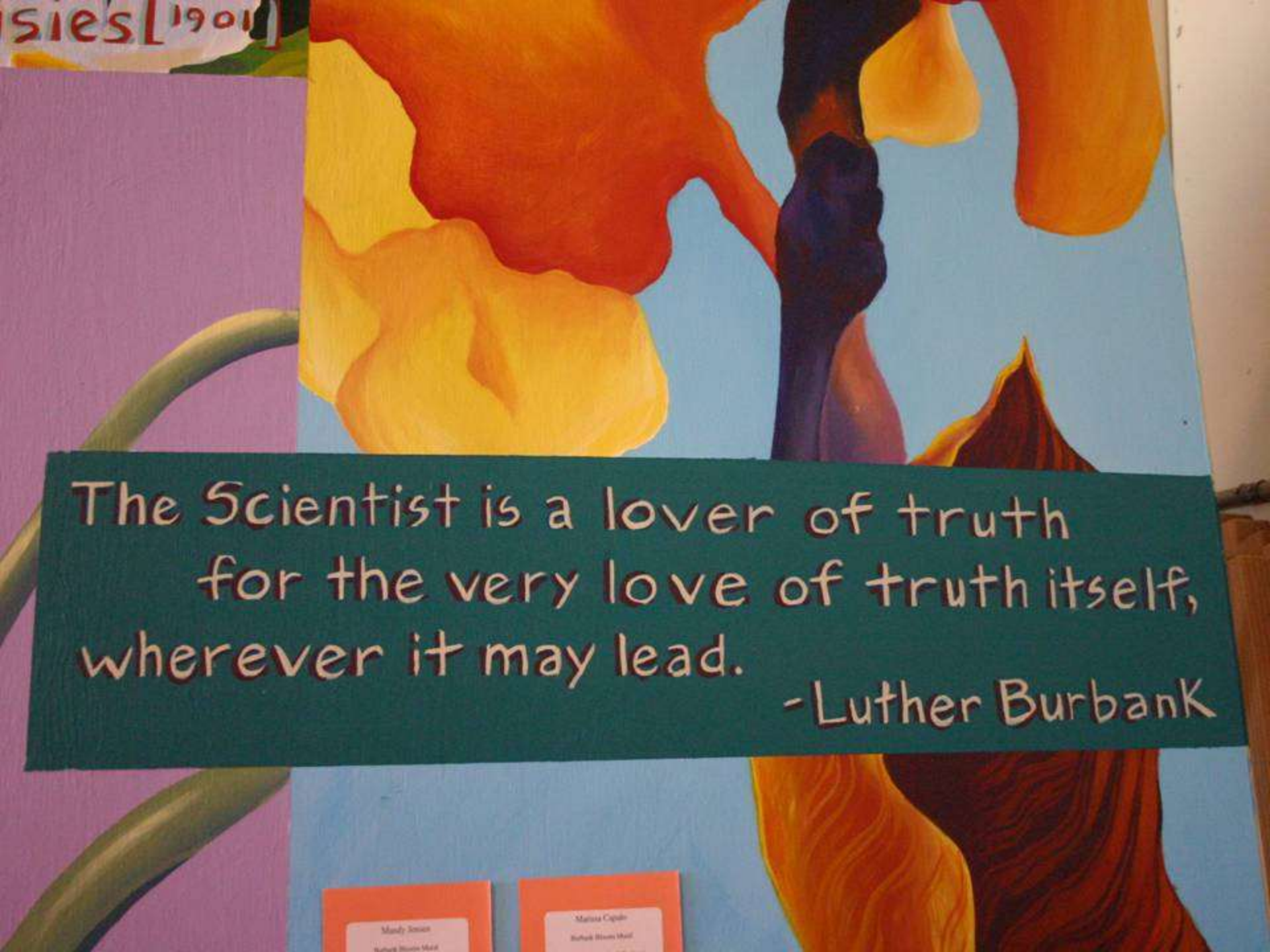
**Research**

**and**

**Education**



sies [1901]



The Scientist is a lover of truth  
for the very love of truth itself,  
wherever it may lead.

-Luther Burbank

Mandy Simon

Burbank House Model

Marissa Caplan

Burbank House Model

# More Information

## <http://fruitsandnuts.ucdavis.edu/>



The header features the University of California logo, the ANR and UCCE logos, and a large image of a fruit orchard. Below the image is the text "fruit & nut RESEARCH AND INFORMATION CENTER".

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Welcome!

Welcome to the  
Fruit & Nut Research and Information Center!

We set up this site so you can easily find what you want in as few steps as possible.

- Our individual crop lists of **Fruits and Nuts** have the latest production information for you.
- Our **General Management** pages provide information about the care and protection of your fruit and nut trees.
- Our extensive **Weather-Related Models** pages can help you predict your harvest and estimate chilling hours.
- Links to other resources, including **The Backyard Orchard** and **UC Cooperative Extension Farm Advisors' Newsletters & Information** may help you with specific information for your growing area.
- Our catalog of **Current UC Research Projects** gives you details about current, ongoing research projects in specific crops and production methods.
- Our **Calendar** lists upcoming events, meetings, and workshops you might want to attend to improve your production of fruits and nuts.

Please drop us an email to let us know how we are doing and what we can improve to make the Fruit and Nut Research and Information Center's vital information more accessible for you. You can reach us at: [fruitsandnuts@ucdavis.edu](mailto:fruitsandnuts@ucdavis.edu)

Seasonal Harvest



View More

What's New

**Olive Notes** newsletter change:

Access new edition subscription here: **NEW** and cancel old subscription here: **OLD**.

**Mechanical harvesting of California table and oil olives** provides an overview of olive harvesting in California [Click here](#) for the pdf.

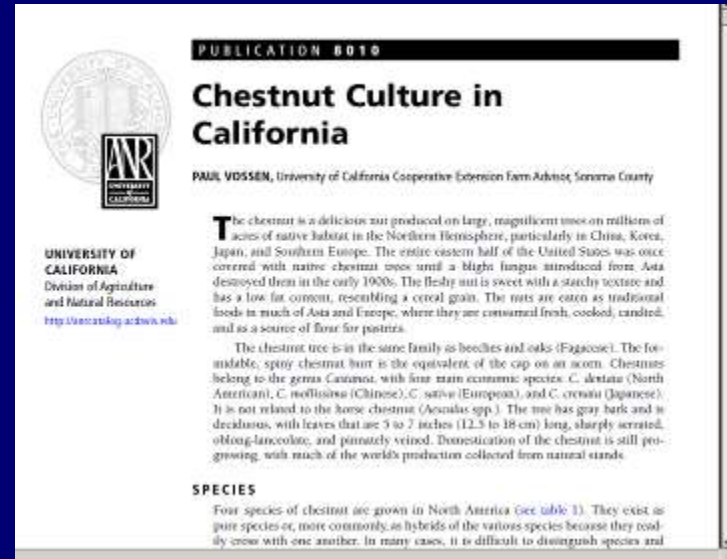
**Walnut Research Reports** for 2009 now available. [Click here](#).

**Asian citrus psyllid** - to learn about this pest, visit: [CaliforniaCitrusThreat.org](http://CaliforniaCitrusThreat.org)



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The cover features the University of California seal and the ANR logo. The title "Chestnut Culture in California" is prominently displayed. Below the title is the author's name, Paul Vossen, and his affiliation with the University of California Cooperative Extension. The text describes the chestnut as a delicious nut produced on large, magnificent trees on millions of acres of native habitat in the Northern Hemisphere. It mentions that the entire eastern half of the United States was once covered with native chestnut trees until a blight fungus introduced from Asia destroyed them in the early 1900s. The text also notes that the chestnut tree is in the same family as beeches and oaks (Fagaceae) and that it is not related to the horse chestnut (Aesculus spp.). The cover includes a section for species, listing four species of chestnut grown in North America and noting that they exist as pure species or, more commonly, as hybrids of the various species because they readily cross with one another.

PUBLICATION 8010

## Chestnut Culture in California

PAUL VOSSEN, University of California Cooperative Extension Farm Advisor, Sonoma County

The chestnut is a delicious nut produced on large, magnificent trees on millions of acres of native habitat in the Northern Hemisphere, particularly in China, Korea, Japan, and Southern Europe. The entire eastern half of the United States was once covered with native chestnut trees until a blight fungus introduced from Asia destroyed them in the early 1900s. The fleshy nut is sweet with a starchy texture and has a low fat content, resembling a cereal grain. The nuts are eaten as traditional foods in much of Asia and Europe, where they are consumed fresh, cooked, candied, and as a source of flour for pastries.

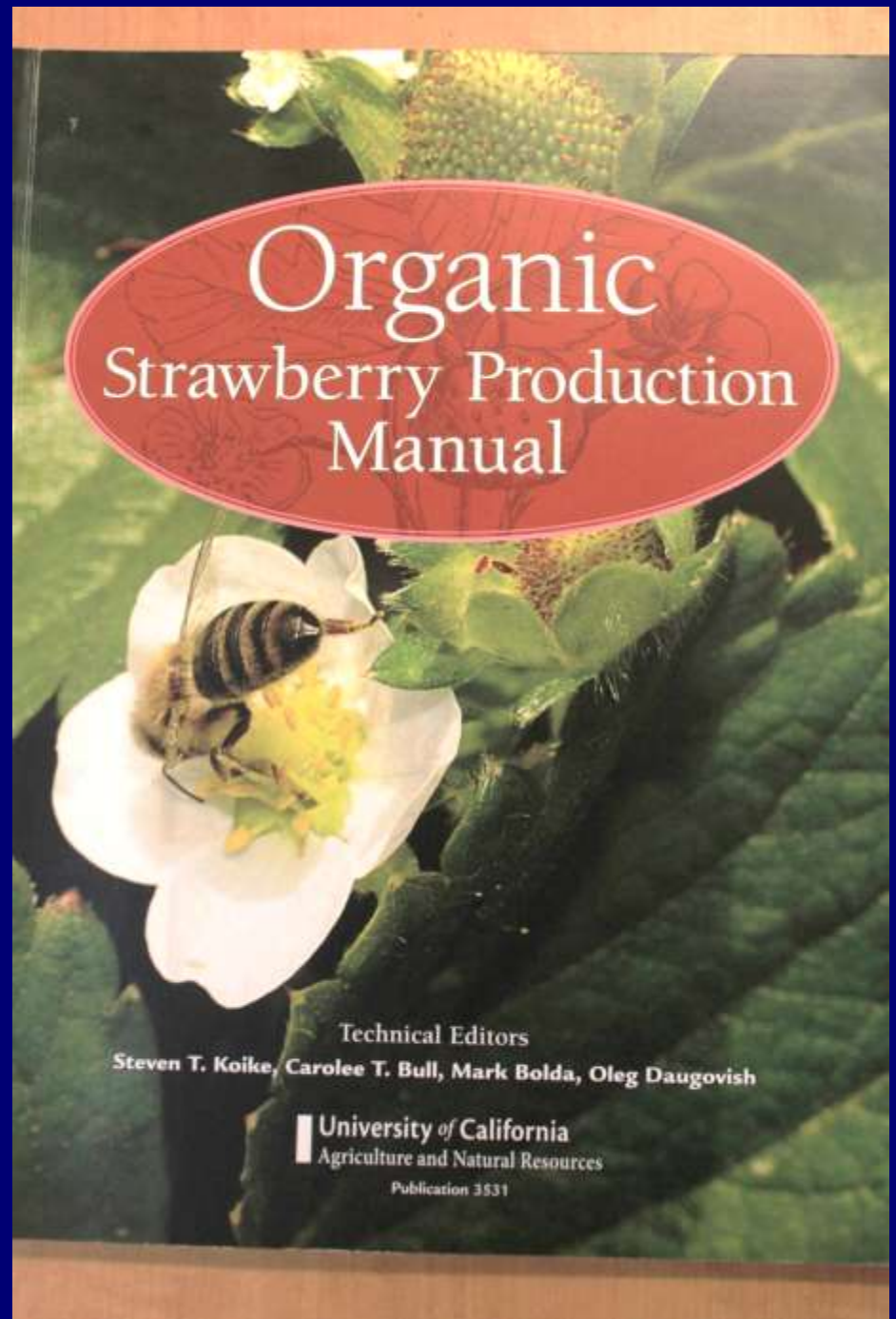
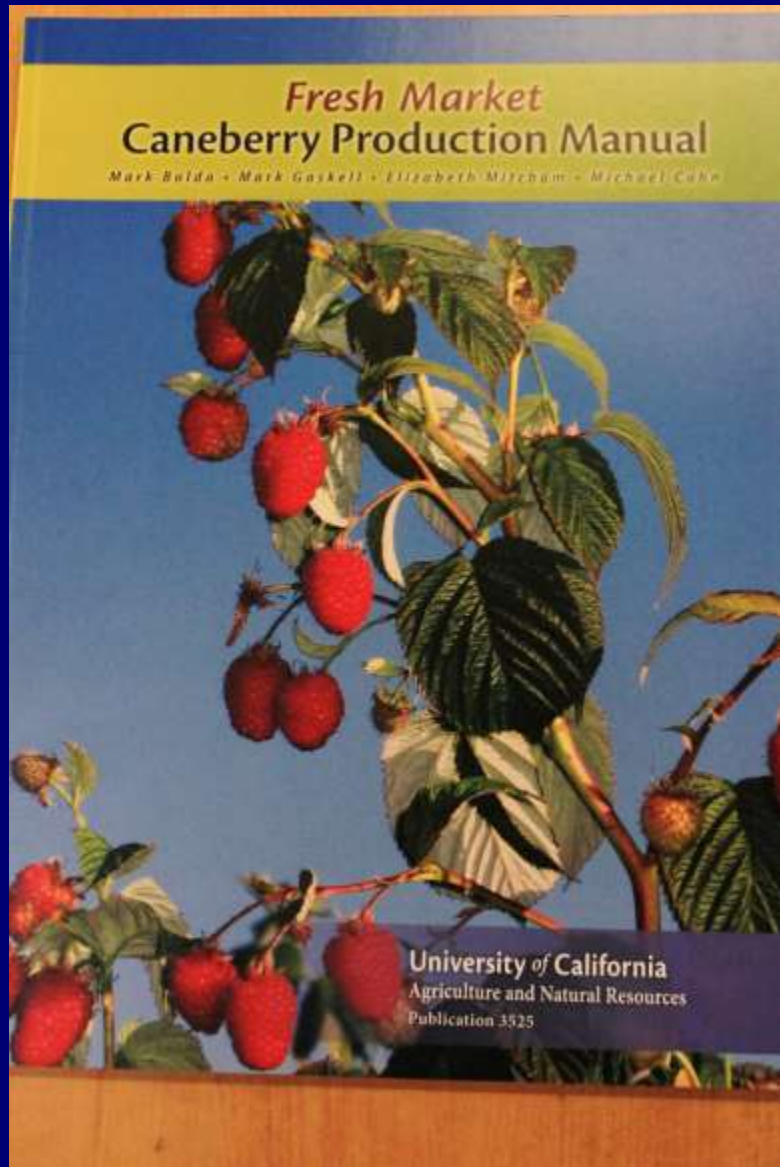
The chestnut tree is in the same family as beeches and oaks (Fagaceae). The formidable, spiny chestnut burr is the equivalent of the cap on an acorn. Chestnuts belong to the genus *Castanea*, with four main economic species: *C. dentata* (North American), *C. mollissima* (Chinese), *C. sativa* (European), and *C. crenata* (Japanese). It is not related to the horse chestnut (*Aesculus* spp.). The tree has gray bark and is deciduous, with leaves that are 5 to 7 inches (12.5 to 18 cm) long, sharply serrated, oblong-lanceolate, and pinnately veined. Domestication of the chestnut is still progressing, with much of the world's production collected from natural stands.

**SPECIES**

Four species of chestnut are grown in North America (see table 1). They exist as pure species or, more commonly, as hybrids of the various species because they readily cross with one another. In many cases, it is difficult to distinguish species and



# Manuals



# UC IPM Guidelines



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**UC IPM Online**  
STATEWIDE INTEGRATED PEST MANAGEMENT PROGRAM



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## Caneberries

### Phytophthora Root Rot

Pathogen: *Phytophthora* spp.

(Reviewed 12/09, updated 12/09)

In this Guideline:

- [Symptoms](#)
- [Comments on the disease](#)
- [Management](#)
- [Publication](#)
- [Glossary](#)

[www.ipm.ucdavis.edu](http://www.ipm.ucdavis.edu)



#### SYMPTOMS

Field symptoms of *Phytophthora* root rot are first noticed when new primocanes (first-year canes) wilt and the shoot tips die back. Floricanes (second-year canes) of affected plants have weak lateral shoots. Leaves turn yellow or scorch from the margins. Often severe wilt and dieback occur during the first hot spell of the season. Roots and crowns are dark brown in color and lack fibrous roots. If the outer surface is scraped from the crown or main roots of recently wilted plants a reddish brown color can be seen with a distinct line where infected and healthy tissues meet. Infected tissue will eventually turn dark brown as the tissue decays.

#### COMMENTS ON THE DISEASE

*Phytophthora* is a soilborne pathogen that survives in the soil as a resting spore (oospore). When soils become saturated with water for prolonged periods, infectious motile spores (zoospores) are released into the soil and can infect raspberry roots or crowns. *Phytophthora* species other than *P. fragariae* var. *rubi* may be involved in root rot of raspberry. (Generally, *Phytophthora* does not cause economic damage to blackberries.) Not all root rots are due to *Phytophthora*. Raspberry roots are very sensitive to excessive moisture in the soil for long periods of time. Root death from lack of air can also occur and result in similar foliar and root decay symptoms.

#### MANAGEMENT

Control is best achieved by planting in noninfested soils that have good drainage. Avoid low-lying areas that receive excessive water or clay soils that are poorly drained. The use of raised beds can improve drainage as can proper irrigation management; this in turn can reduce disease incidence and severity. Use clean plant stock, plant in noninfested soils, and use cultivars suitable for local conditions that are less susceptible to root rots.

#### Variety Tolerance

Many blackberry cultivars appear to be highly tolerant to *Phytophthora*, whereas red raspberries are in the main fairly susceptible, with the varieties Latham, Killarny, Caroline, and Nordic most tolerant and the varieties Ruby, Hentage, and Polana most susceptible.

#### Organically Acceptable Methods

Proper site selection with good water management and the use of clean stock and appropriate cultivars are acceptable management tools in an organically certified crop.

#### Treatment Decisions

Preplant fumigation can reduce initial disease inoculum to allow for plant establishment in heavily infected sites, though the pathogen will recolonize the area with time. Properly timed fungicide applications may also reduce disease incidence in established plantings.

Common name  
(trade name)

Amount/Acre

R.E.I.+  
(hours)

P.H.I.+  
(days)





# Economics

[coststudies.ucdavis.edu](http://coststudies.ucdavis.edu)

**Can Money be  
Made?**

# UC Cost Studies

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2005

## SAMPLE COSTS TO PRODUCE FRESH MARKET RASPBERRIES



**Central Coast Region**  
Santa Cruz and Monterey Counties

BK-CC-08

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2008

## SAMPLE COSTS TO ESTABLISH AND PRODUCE FRESH MARKET BLACKBERRIES



**Central Coast Region**  
Santa Cruz and Monterey Counties

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# Department of Horticulture

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## Berries and Small Fruits

### About Berries and Small Fruits at Oregon State University

The superb quality of Oregon's blackberries, blueberries, raspberries, strawberries, and cranberries are known worldwide, adding a farm value of over \$140 million to local economies. Consumers are attracted to products, local markets, U-pick,...[read more](#)



### For Students

#### Courses in Berries and Small Fruits

Students learn berry production within the context of plant biology and genetics, soils, ecology, and economics with applications in plant..

### Research and Extension

#### Northwest Berry and Grape Infonet

The Northwest Berry & Grape Information Network is the most comprehensive information and communications resource for berry and grapes.

#### Extension Publications for Berries and Small Fruits

Resources from Oregon State's Extension Services on berries and small fruits.

### People

# Other UC People



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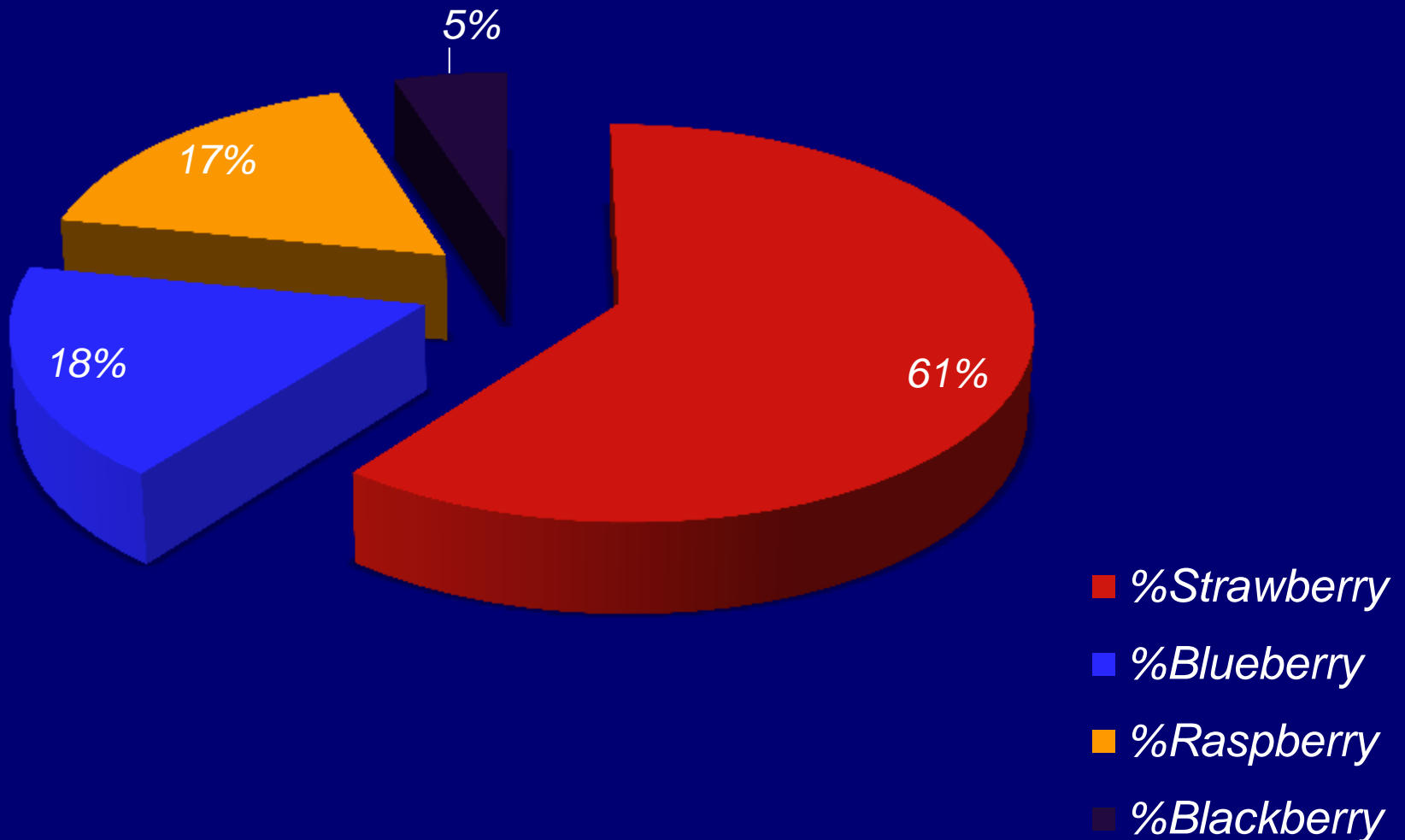
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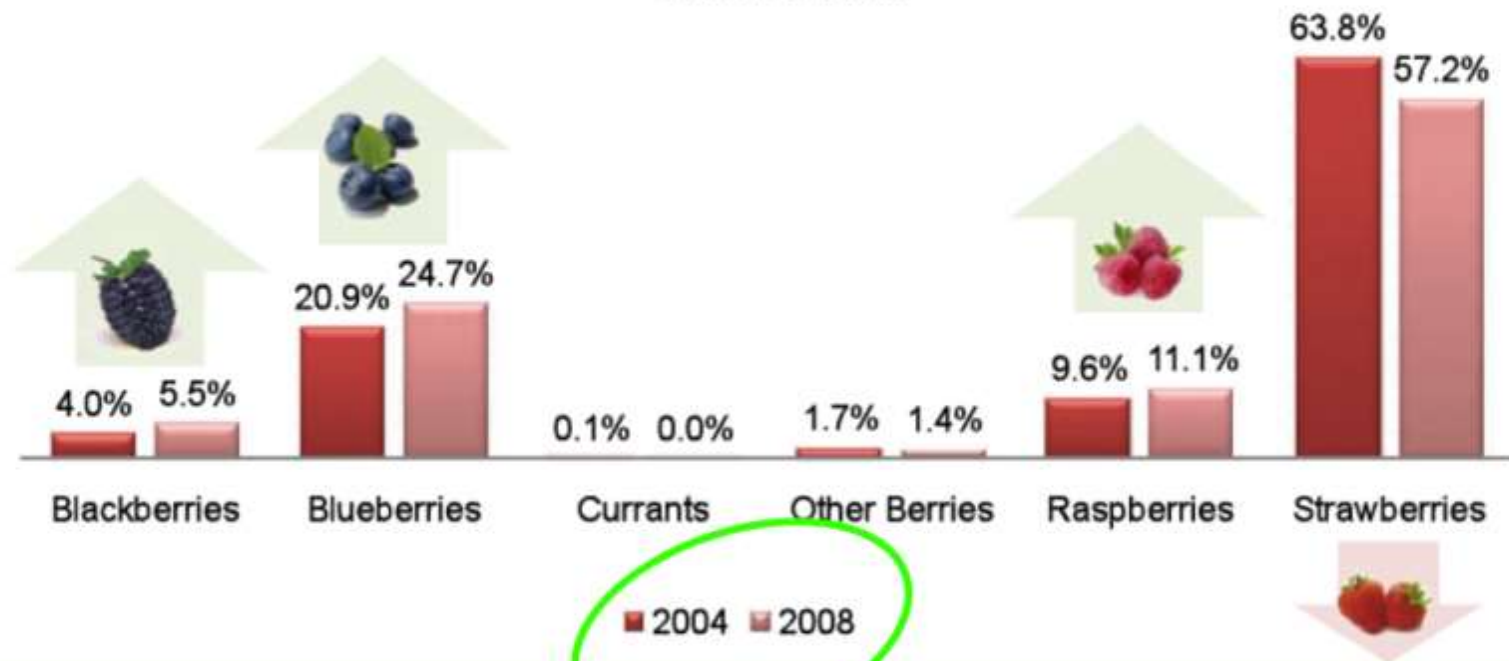
# ***2014 Total US Berry Sales (flats)***





## Consumer demand for small fruits - US

**Subcategory Contribution to Total Berries  
2004 vs 2008**







## Blueberry nutraceutical value

# BLUEBERRIES

## A Handful of Health

Plump, juicy, and sweet, with vibrant colors ranging from deep purple-blue to blue-black and highlighted by a silvery sheen called a bloom, blueberries are one of nature's great treasures. Though miniature in size, they are also proof that, when it comes to health benefits, good things really do come in small packages.



### BLUEBERRIES ARE...

#### LOW IN FAT.

A one-cup serving contains only 80 calories and virtually no fat.

#### FULL OF PHYTONUTRIENTS.

Research suggests that the phytonutrients in blueberries, called polyphenols, have antioxidant and anti-inflammatory properties that may help lessen the inflammatory process associated with chronic conditions such as cardiovascular disease, cancer, and other age-related diseases.<sup>1,6,7</sup>

#### FULL OF DIETARY FIBER.

A handful of blueberries helps satisfy recommended daily fiber intake.<sup>2</sup>

Fiber helps keep the body regular, the heart healthy, and cholesterol in check.<sup>3</sup>

#### PACKED WITH VITAMIN C.

One serving delivers almost 25% of one's daily requirement of vitamin C.<sup>8</sup>

Vitamin C aids collagen formation and helps maintain healthy gums and capillaries and a healthy immune system.<sup>5</sup>

#### AN EXCELLENT SOURCE OF MANGANESE.

Manganese plays an important role in bone development and in converting proteins, carbohydrates, and fats into energy.<sup>4</sup>



# Keys to Successful Berries

1. Good Soil - plant high (mound)
2. Good Climate (cool & low rainfall)
3. Good Water - zero drought stress
4. Right variety
5. 100% weed control
6. Adequate fertilizer
7. Control / prevent pests
8. Pruning = remove excess wood and weak growth - prevent over production
9. Spacing – cane berries ~ 9-10 ft. between rows and 1-3 ft. within rows, strawberries ~ 8-12” between plants double or single beds
10. Replant frequently





# What Conditions Are Best For Berries?

## Regional Conditions

- **Cool summers**
- **Mild to cold winter (400 to 1,000 hours chilling)**
- **Dry spring and summer**
- **No frost at bloom (April)**

# ~~Local Conditions~~

- **Deep, well drained soils**
- **~~Lack of weed competition~~**



# Soil Physical Properties

## Prefer

- Sand
- Sandy loam
- Loam
- Silt loam

## OK

- Clay loam
- Silty clay loam

## Avoid or Change

- Clay soils  
(slow drainage)



# Strawberry Root Diseases



**Drainage is one of the most important factors**

# Raised Beds

- Warmer – growth starts earlier
- Higher – easier to harvest
- Better drainage
- Less root rot





# Beds and Plastic





# Forming Hand Raised Beds







**Spread compost 1 ft. thick – till in – form raised beds**





# Forming 2 Raised Beds



**Listers**





# Lister





# Listing – raised beds





# Bed Prep for Blueberries





# Rototiller Bed Shapers



# Bed Shaper





# Bed Shapers





# Shaping Beds







## Bed forming with fertilizer and drip tape





# Plastic Mulch



# Advantages of Plastic Mulch

- Fruit rot
- Weed control
- Temperature Control
  - Clear = warms soil
  - Black = warms surface
  - White = cools soil





# Early-season plant growth & fruiting with clear and black bed tarps, January



**Clear  
(transparent)**

**Black**

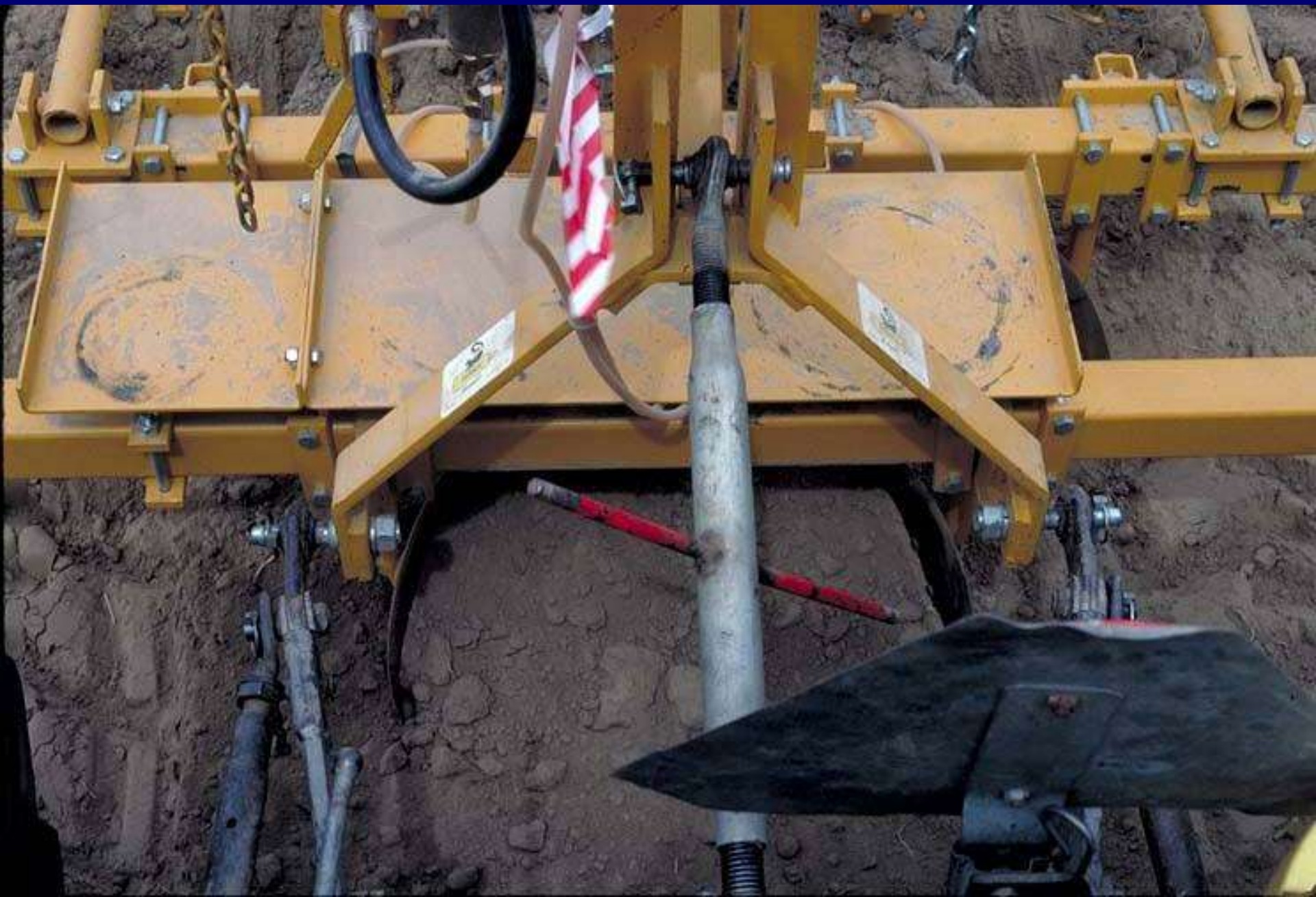


# Plastic Mulch Machine





# Plastic Mulch Machine





# Plastic Mulch





# Two row strawberry bed

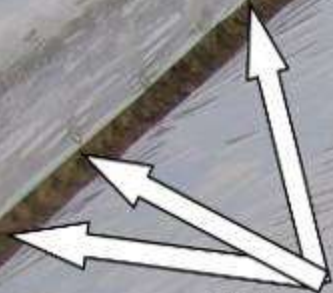
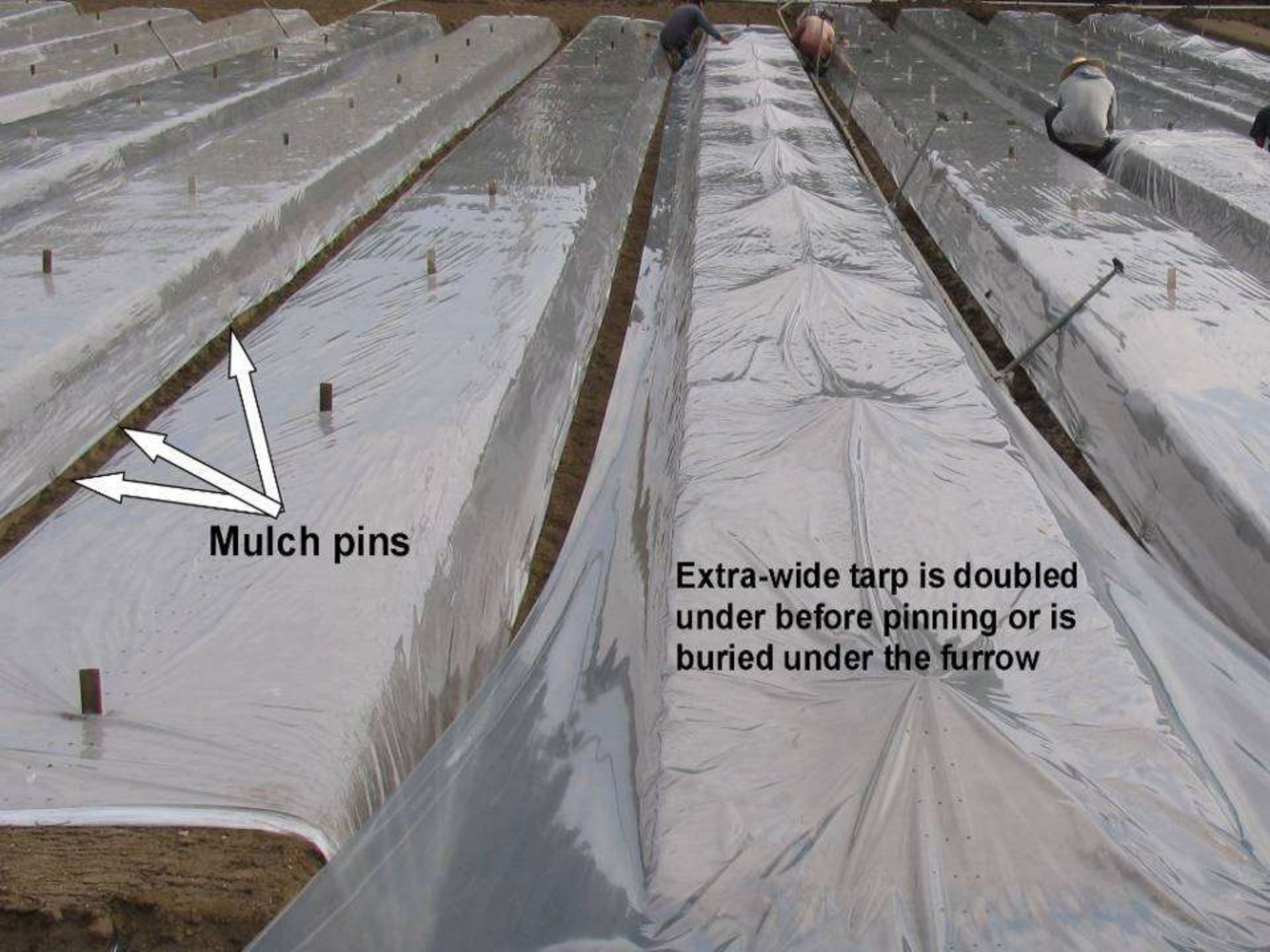
$12 + 12 + 36 = 60''$  (5 ft.) plastic



Use 6-7 ft. wide plastic and burry it on edges







**Mulch pins**

**Extra-wide tarp is doubled under before pinning or is buried under the furrow**

# Wire staple plastic on side





# Hand Buried Plastic





**Burner to  
melt holes  
in plastic**





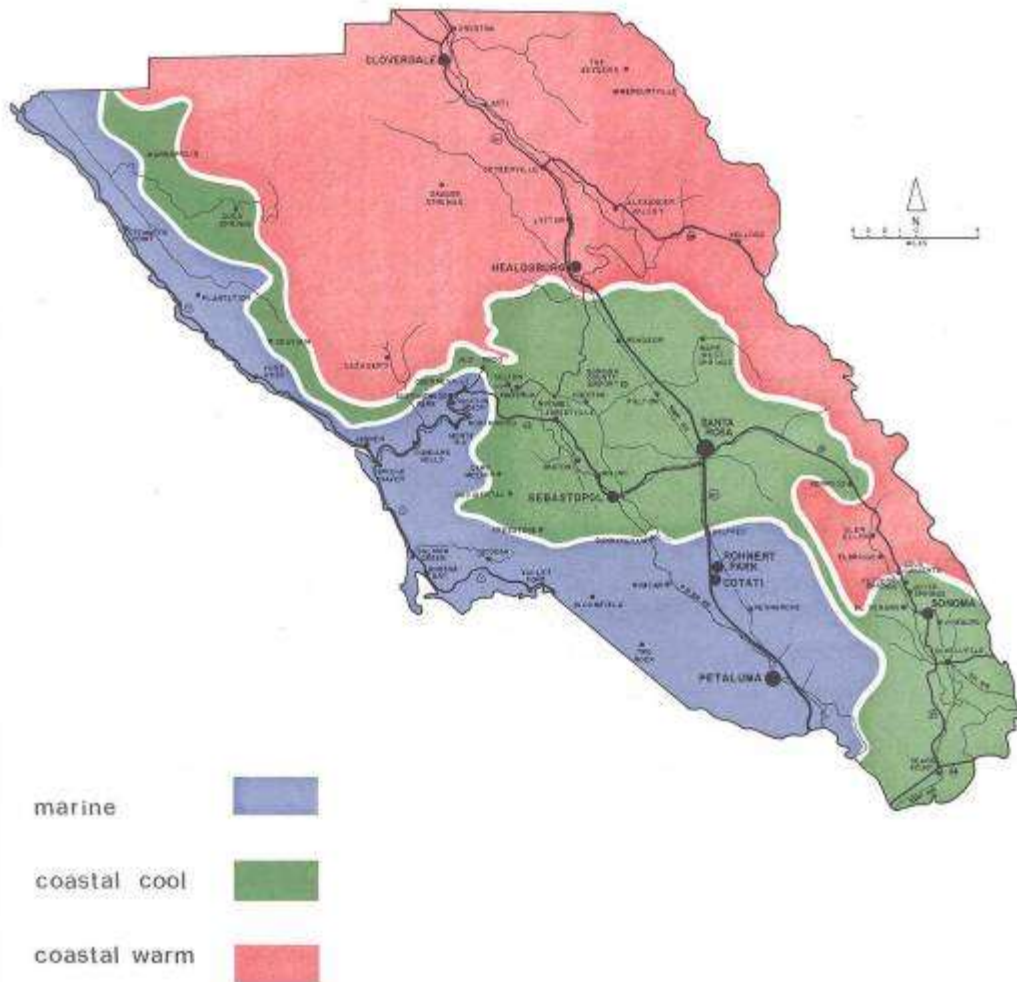
# Melting holes in plastic







## SONOMA COUNTY climatic zones



Marine  
Coastal Cool  
Coastal Warm

# 1° Climatic Zones

**Marine:** Foggy, windy, cool

- 2,185 degree days (1,800-2,800)
- Water use ~ 20-22"

**Coastal Cool:** Intermediate – some fog

- 2,582 degree days (1,900-3,600)
- Water use ~ 30-34"

**Coastal Warm:** Warm – little fog

- 2,920 degree days (2,100-4,200)
- Water use ~ 36-42"



# ET Rates in the Press Democrat

Sonoma	71/53	0.00	40.74	20.71
St. Helena	77/59	0.00	23.71	19.48
Ukiah	75/56	0.00	39.05	28.23
Windsor	79/55	0.00	40.17	23.29
			34.14	21.03

\*Season runs July 1 through June 30

## RECORDS FOR TUESDAY SANTA ROSA

Average  
temperatures:  
High 77, Low 51

Record low:  
38 in 1933

Record high:  
95 in 1991

Average rainfall  
since July 1:  
30.83 inches

## FARM REPORT

Evapotranspiration:	Dewpoint:	
ETo Yesterday	0.17	8 a.m. Wednesday 53
ETo Last 7 days	1.05	2 p.m. Wednesday 60
ETo next 7 day	2.24	High/Low Thu. 62/53

Earthquake news: (510) 642-2160

River flow: (707) 944-5533 (Sonoma, Marin,  
Mendocino, Humboldt, Del Norte)

## VHF Radio

North Bay: 162.40 MHz  
South Bay: 162.55 MHz  
Sonoma Mt: 162.475 MHz

**PRESSDEMOCRAT.COM**  
FOR CONTINUOUS NEWS AND WEATHER



## LAKE

Lake So  
Capacity:  
245,043  
100.09%

Lake M  
Capacity:  
105,077.  
Elevation

Lake Pill  
Capacity:  
Water sup  
1,908 feet

Russian R  
At Haciend

Clear Lak  
7.03 feet R  
1,318.26 fe

## INDEX Ultravio

0 5  
Low Mod

The higher the A  
UV Index™ num  
greater the need  
skin protection. S  
highest value of

# Seasonal Water Requirement

April - October (30 yr. average in inches) (Sonoma County)

	<u>Marine</u>	<u>Coastal Cool</u>	<u>Coastal Warm</u>
April	2.8	4.0	4.5
May	2.9	5.8	6.9
June	2.8	5.6	7.0
July	3.4	6.1	7.9
August	3.1	5.2	6.8
Sept.	3.1	4.4	5.7
Oct.	<u>3.1</u>	<u>3.3</u>	<u>3.7</u>
TOTAL	21.2	34.4	42.5



# Water Use in Gallons / Day

	0.1"/day	0.2"/day	0.25"/day	0.3"/day
1 ft <sup>2</sup>	0.062	0.125	0.156	0.187
10 ft <sup>2</sup>	0.62	1.25	1.56	1.87
36 ft <sup>2</sup>	2.25	4.50	5.61	6.73
100 ft <sup>2</sup>	6.20	12.5	15.6	18.7
200 ft <sup>2</sup>	12.4	25.0	31.2	37.4
300 ft <sup>2</sup>	18.6	37.5	46.8	56.1
1 acre	2,715	5,431	6,788	8,146

*5 gpm X 60 min/hr X 24 hrs/day = 7,200 gallons per day*

# BERRY DRIP IRRIGATION

- Water Use is 0.25 Inches per day in Summer
- Typical bed = 3 ft. wide x 100 ft. long = 300 ft<sup>2</sup>
- Water use is 46.8 gallons per day (50 gallons)
- drip-tape has ½ gallon per hour emitters spaced 1 ft. apart (2 lines per bed) = applies 100 gal/hr
- Water every day for 30 minutes or every other day for 1 hour





**Drip irrigation wets 80-100% of root system for vegies and berries**





# Two rows of drip tubing





# Two rows of drip tape





# Irrigation system





# Drip Emitters



# Emitter tubes on Main



**Lots of options**







# Mini Sprinklers

**2 - 4 times  
per week to  
wet down  
12-18"**









# Berry Irrigation



**Applies  
1½" per hour**

**Run 1 hr.  
Every 2 days**

**Or  
2 hours / 4  
days**

---

**1" soaks down  
6" into soil**

# Berry Nutrition - Fertilizers

- Cover crops
- Compost – manure
- Concentrated organic fertilizers
- Conventional fertilizers





# Compost or Manure – prior to planting



# 10 vs. 20 tons/acre



- Cubic Yard ( $\text{yd}^3$ ) = about 850 lbs. = 0.43 tons so  $5 \text{ yd}^3 = 2 \text{ tons}$
- $10 \text{ tons/a} = 24 \text{ yd}^3$  at \$15 per  $\text{yd}^3$  = \$360 + delivery and spreading



# Organic Matter Tilled In





# Cover Crops





# Cover Crop – Grass & Legume





# Tilled in prior to planting







**Sub clover and  
Zorro Fescue –  
winter and spring  
growth**

**Sub clover drying  
out in the late  
spring**



# Caneberry Tissue Analysis

Nutrient	Recommended Amount
Nitrogen	2.3 -3 %
Phosphorous	0.19-0.45%
Potassium	1.3-2.0%
Calcium	0.6-2.0%
Magnesium	0.3-0.6%
Sulfur	0.1-0.2%
Manganese	50-300 ppm
Boron	30-70 ppm
Iron	60-250 ppm
Zinc	15-50 ppm
Copper	6-20 ppm
Molybdenum	1- 2 ppm

From :

[http://smallfarms.oregonstate.edu/sites/default/files/sf\\_nutrient\\_management\\_berrries\\_sept\\_7\\_2013\\_strik.pdf](http://smallfarms.oregonstate.edu/sites/default/files/sf_nutrient_management_berrries_sept_7_2013_strik.pdf)



# Importance of Tissue Nitrogen

Nutrient (% and ppm)	Average – Green Leaf	Average – Yellow Leaf
% Nitrogen	2.6	1.7
% Phosphorous	0.23	0.16
% Potassium	1.53	1.4
% Calcium	1.8	2.2
% Magnesium	0.57	0.64
% Sulfur	0.18	0.17
Copper (ppm)	7.0	6.9
Zinc (ppm)	16	18
Iron (ppm)	460	650
Manganese (ppm)	740	675
Boron (ppm)	86	117
Sodium (ppm)	185	293
Chloride (ppm)	3667	4136
Nitrate (ppm)	446	318

# Importance of Soil Nitrogen

Data	Sample Description*				
	Healthy Green	Yellow 1	Yellow A	Yellow 2	Yellow 3
NO <sub>3</sub> -N (ppm)	33	4.2	16	4.7	<2
P (ppm)	120	98	130	100	130
K (ppm)	240	580	340	210	260
Ca (ppm)	3300	3000	2700	2000	2300
Mg (ppm)	840	550	400	340	400
SO <sub>4</sub> -S (meq/L)	8.6	1.3	7.5	4.3	4.2
Na (ppm)	100	74	53	40	50
Cl (ppm)	110.1	22.0	23.8	22.7	34.8
CEC (meq/100 g)	24	21	19	13	16
pH	7.1	6.9	5.5	6.8	7.2

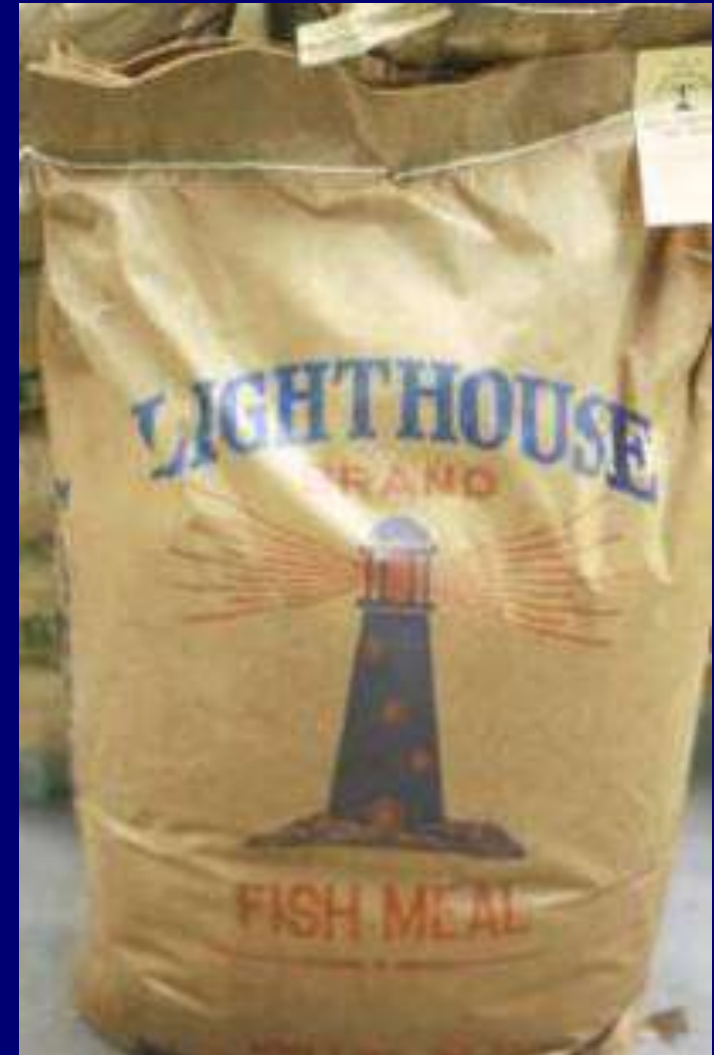


# Raspberry Nutrients

## Compost – Regular Fertilizers – Slow Release Fertilizers

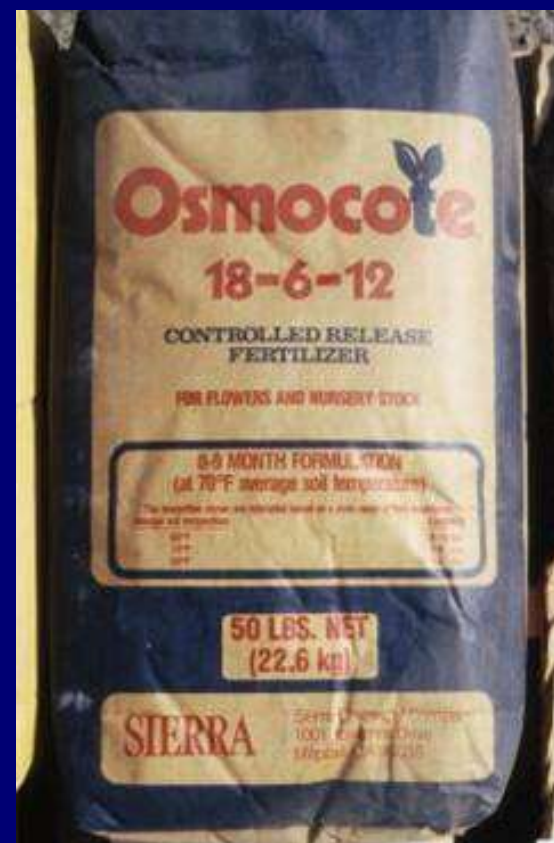
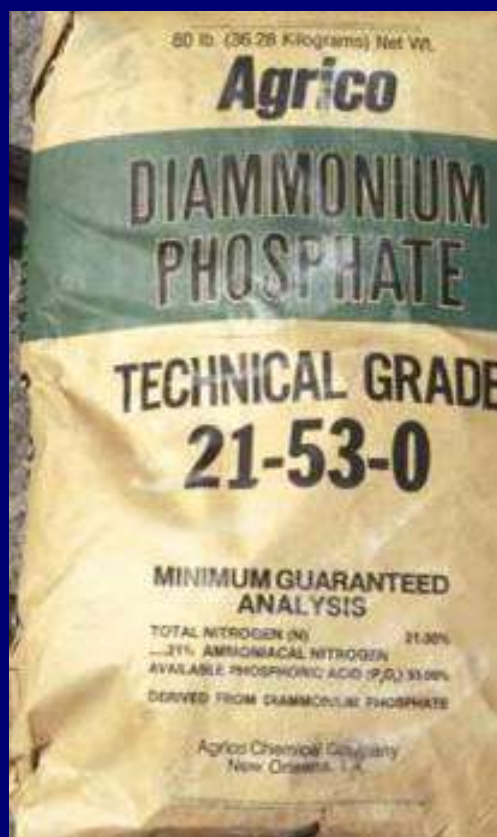


# Concentrated dry organic fertilizers – in a bag





# Conventional Fertilizers and Slow Release Fertilizers



# Slow Release Fertilizers





# **Fertilizers for Blueberries**

## **pH below 5.0**

- **Best = Ammonium sulfate & compost**
- **Excellent = Slow release**
- **OK = Urea, Amm. phosphate**

-----

- **Avoid = Sodium nitrate, Amm. nitrate**
- **Avoid = Calcium nitrate, potassium nitrate**
- **Avoid = Lime (calcium carbonate)**
- **Avoid = salts containing sodium**

# Soil sulfur to lower pH

Sulfur (elemental) + oxygen + water = sulfuric acid + soil calcium





# Soil pH

Sulfur (elemental) + oxygen + water = sulfuric acid + soil calcium



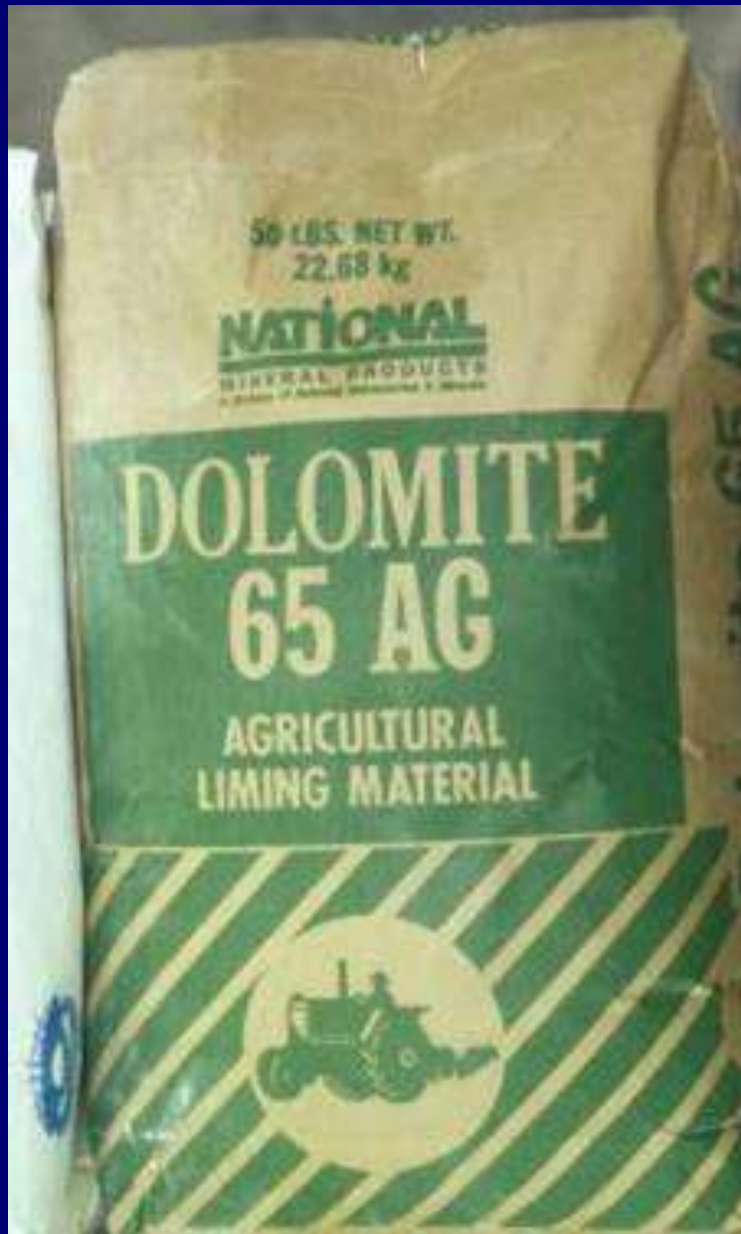
Change pH  
from 7.5 to 5.5  
= 0.5t/a (sandy  
soil) to 1.0t/a  
(clay soil)

45 to 90 lbs.  
per 1,000 ft<sup>2</sup>

# Changing Soil pH

- Pine needles: 100-1,000 years
- Peat moss: 100-1,000 years
- Sulfur: 1-2 years
- Sulfuric acid: 6 months to 1 year
- Acid type fertilizers (ammonium sulfate, urea and ammonium nitrate): 10-20 years





50 LBS. NET WT.  
22.68 kg

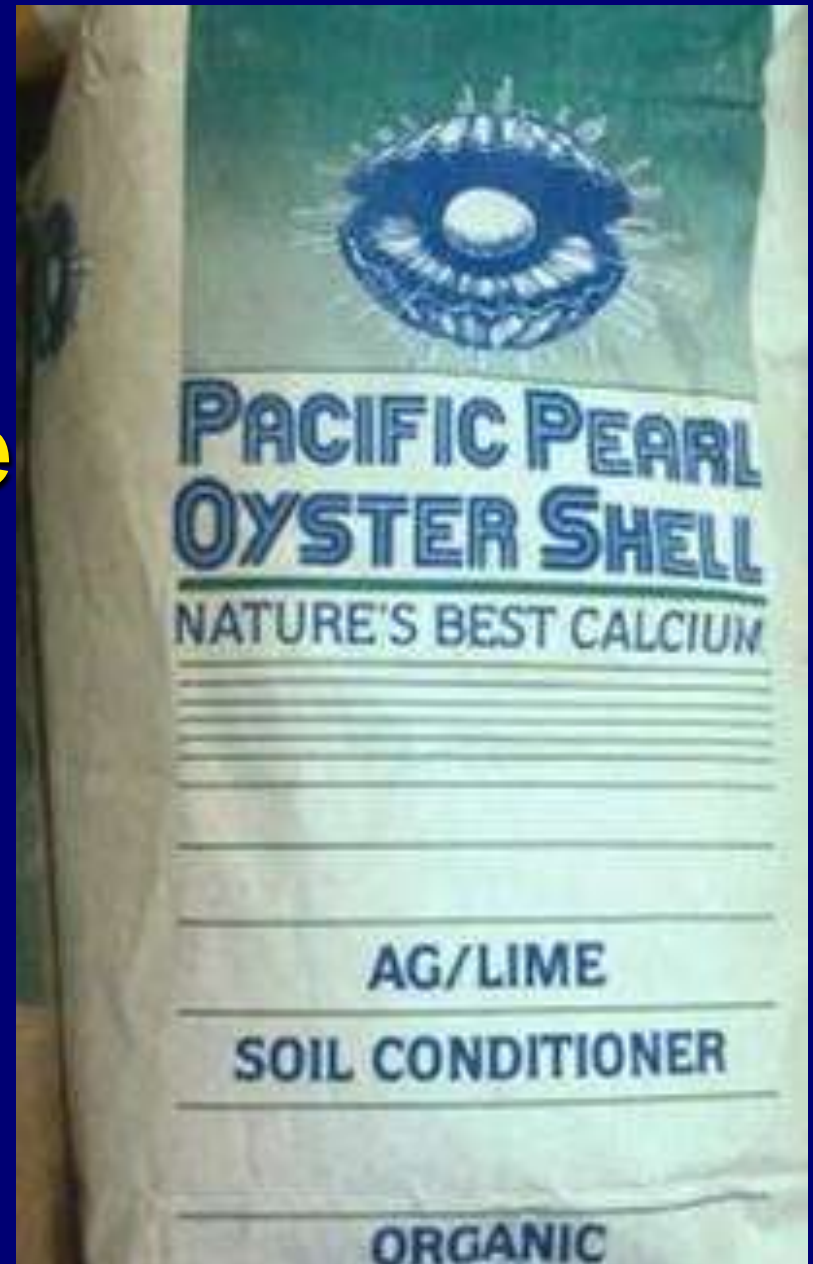
**NATIONAL**  
MINERAL PRODUCTS  
A Division of National Industrial & Marine

**DOLOMITE  
65 AG**

**AGRICULTURAL  
LIMING MATERIAL**



**Lime**



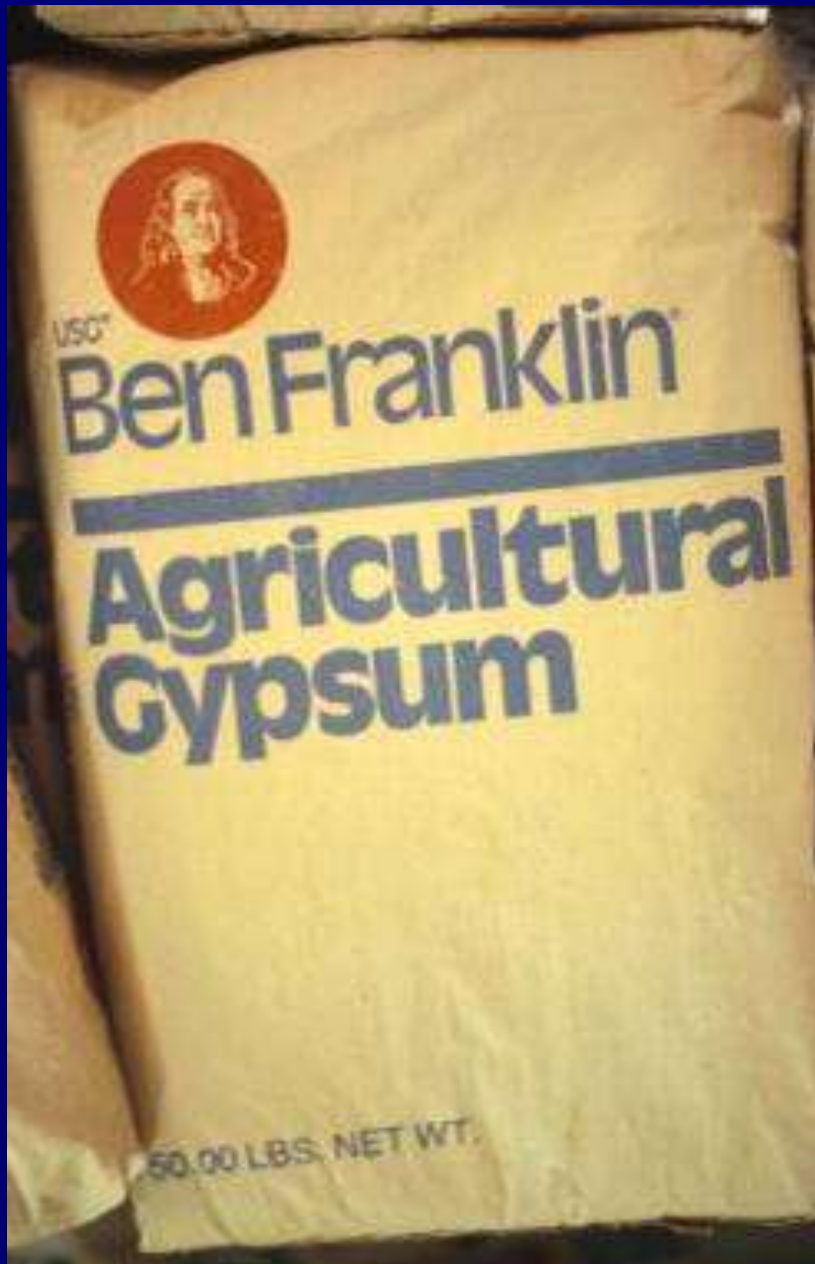
**PACIFIC PEARL  
OYSTER SHELL**

**NATURE'S BEST CALCIUM**

**AG/LIME**

**SOIL CONDITIONER**

**ORGANIC**



**Gypsum =  
Calcium Sulfate**

**Separates**

- 1. Calcium in soil**
- 2. Sulfate +  
Sodium**

**= Sodium Sulfate**

**Leaches out**

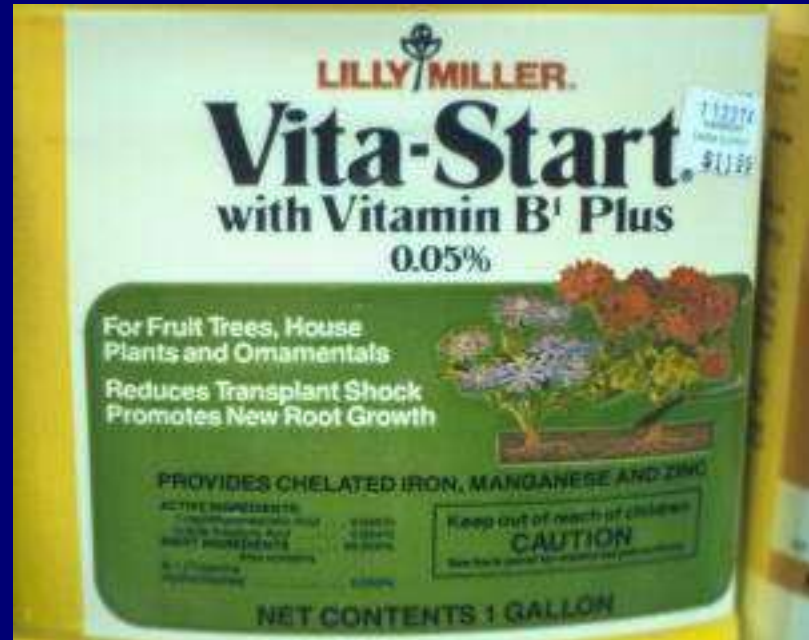


# Foliar Sprays and Rock Dust



# Snake Oils?

- Bio Enhancer
- Fish Emulsion
- Kelp
- Green All
- Rock Dust
- Natures Goodness in an Organic “Pill”
- Foliar feed of conventional nutrients





# Organic Fertigation



# Organic Nutrient Solution



**Injected into drip lines**





# Solution Can't Plug Emitters





# Death Taxes Weeds



**Very  
competitive  
on young  
plants**



# Weed Control





**Hoe**



**Weed cloth**

**Mulch**





# Plastic Mulch





# Blueberries – white plastic





**BAD = heavy soil & no mulch**









# Weed control

Organic mulch

Cloth mulch

Hand



# Growing Berries





# Berry Types

- Blueberries (Vaccinium species)
- Raspberries (Rubus species)
- Blackberries (Rubus species)
- Strawberries (Fragaria species)
- Currants (Ribes species)
- Gooseberries (Ribes species)
- Mulberries (Morus species)

# Blueberries



- Soil pH
- Varieties
- Plant age and size
- Plant spacing & depth
- Irrigation
- Fertility (nutrition)
- Pruning
- Pest control (weeds, insects, disease, birds)



# Wild Blueberries



# Blueberry - Old Varieties

Early Blue - Med. size, good flavor; erect, very susceptible to root rot.

Duke - Med. size, firm, good flavor; vigorous, erect, open, productive.

Spartan - Very large, firm, excellent flavor; erect, open, productive.

Patriot - Very large, excellent flavor; vigorous, erect, very productive.

Collins - Large, firm, excellent flavor; medium-sized, productive plant.

Bladen - Medium sized, vigorous upright growth, low chill.

Blue Ray - Very large, firm, excellent flavor; vigorous, erect, productive.

Chandler - Extremely large, excellent flavor; moderate vigor.

Blue Crop - Very large, firm, good flavor; vigorous, erect, productive.

Rancocas - Very small with intense flavor; vigorous, dense, bush.

Berkeley - Very large, firm, mild flavor, vigorous, spreading, productive.

Nelson - Very large, excellent flavor; vigorous, high yielding.

Darrow - Medium-sized, firm, excellent-flavor; erect, productive.

Late Blue - Large, firm, good flavor; vigorous, erect, productive.

Elliott - Medium sized, mild flavor, tart, vigorous, erect, productive.

**In order of ripening - Early to Late**



# Blueberry - New Varieties

- Biloxi
- Blue Crisp
- Cape Fear
- Dublin
- Echota
- Emerald
- Georgia Gem
- Golf Coast
- Jewel
- Jubilee
- Legacy
- Magnolia
- Marimba
- Misty
- Nui
- O'neal
- Ozarkblue
- Reka
- Revielle
- Sampson
- Santa Fe
- Sharpblue
- Sierra
- Southmoon
- Star
- Toro



## Some of the Best New Varieties





# Blueberry Variety Trials

**Table 10.** Replicated Variety Trial, lbs/acre

Legacy	7289	a
Jubilee	6540	ab
Star	6039	b
South Moon	4701	c
Misty	4453	c
Sharp Blue	4319	c
Ozark Blue	2346	d
O'Neal	1669	d
CV		17.93
LSD	<b>Manuel Jimenez</b>	1232

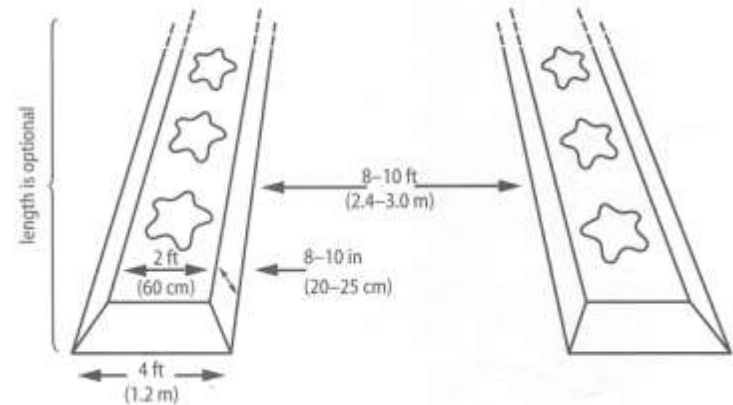
# Blueberry Variety Yields

Cultivar	2005	2006	2007
	..... lb/acre .....		
Emerald	10,747	18,494	19,623
Jewel	8,411	26,966	23,228
Star	3,821	9,968	17,198
Reveille	7,081	7,039	8,313
O'Neal	3,830	7,232	9,708
Misty	7,375	8,128	11,157
* Yield was calculated from 21 feet of row including seven plants spaced 3 feet apart.			



# Spacing 4 – 10 ft.

Approximate dimensions of cane and bush berry raised beds.



# Blueberry in-row plant spacing

**Table 8.** Plant Spacing- Misty, Lbs/Acre

18"	7660	a
24"	6524	ab
30"	5694	bc
36"	5056	cd
42"	4016	de
48"	3274	e
CV		16.10
LSD	Manuel Jimenez	1303



# Blueberry in-row plant spacing

**Table 6.** Plant Spacing- O'Neal, lbs/acre

24"	2567	a
18"	2408	ab
30"	1967	ab
36"	1592	ab
42"	1411	ab
48"	1127	b
CV		46.85
LSD	Manuel Jimenez	1303

# Blueberry Plants

- Get the biggest
- Plant shallow
- Spread roots
- Compost & Mulch
- Don't prune 1<sup>st</sup> yr.
- Space 4' X 10'













# Blueberries don't like weeds







**Sawdust or  
wood chip  
mulch**



# New plant – raised bed – mulch



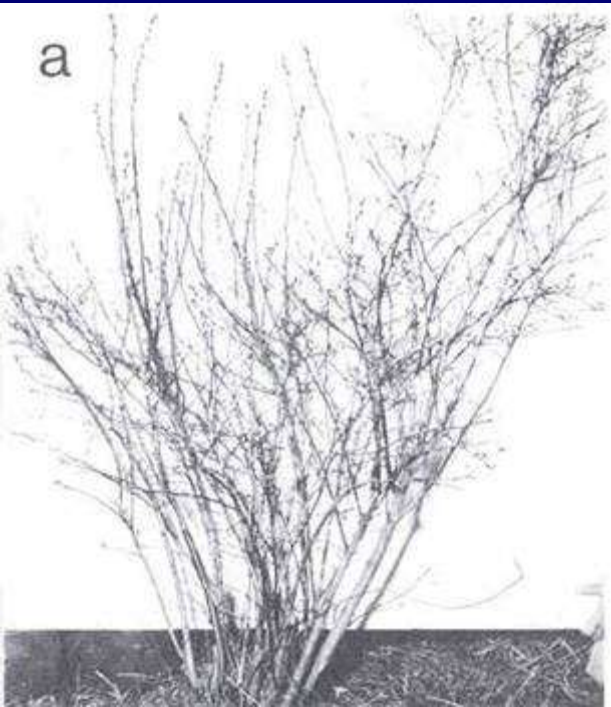


# Mechanical Harvest





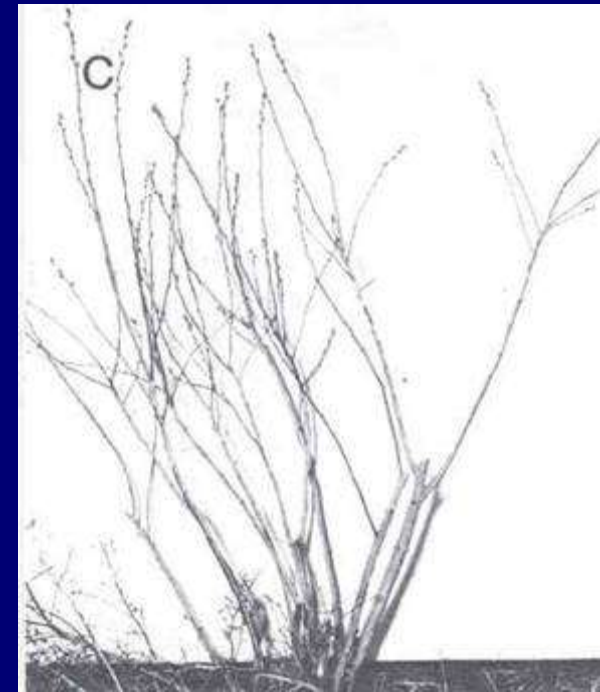
# Pruning Blueberries



**Before**



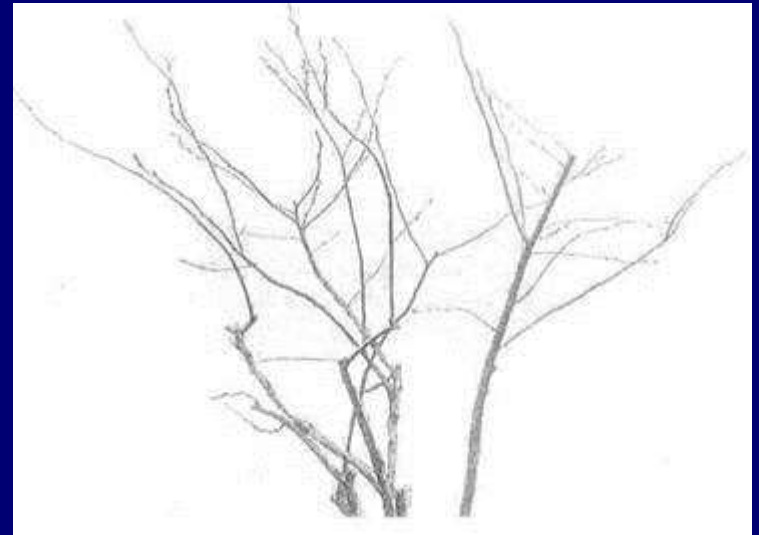
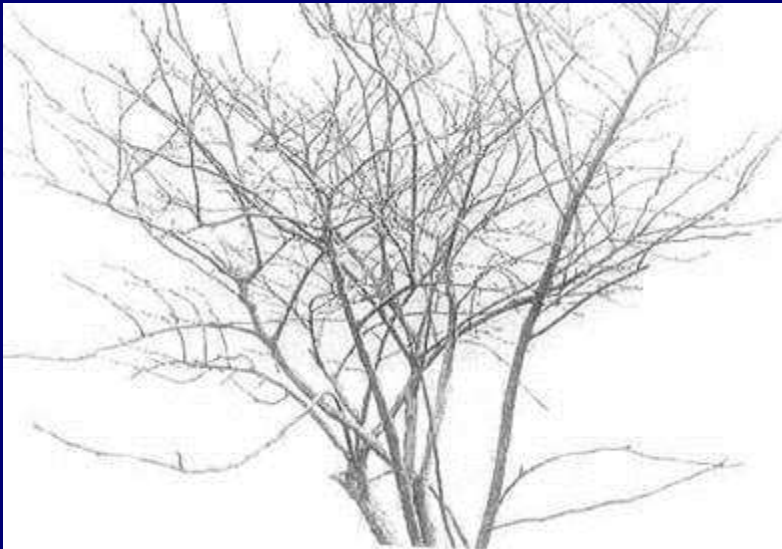
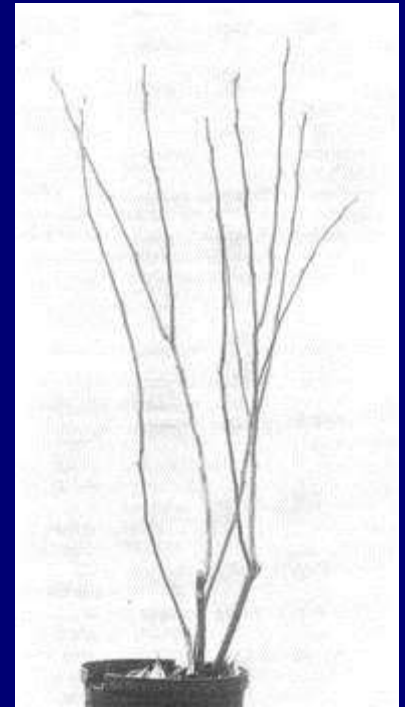
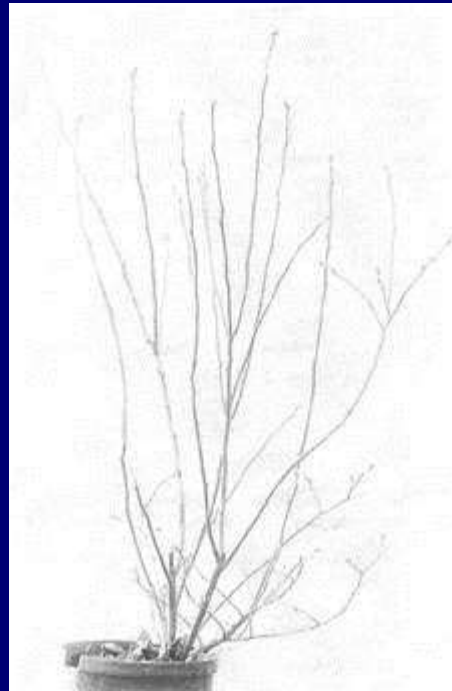
**After**



# Pruning Blueberries

Remove all  
small wood

Do not top





**Flowers at the  
tips of branches**



# Blueberry Pests





# Bird Control Netting









# Shade Cloth – Bird Netting



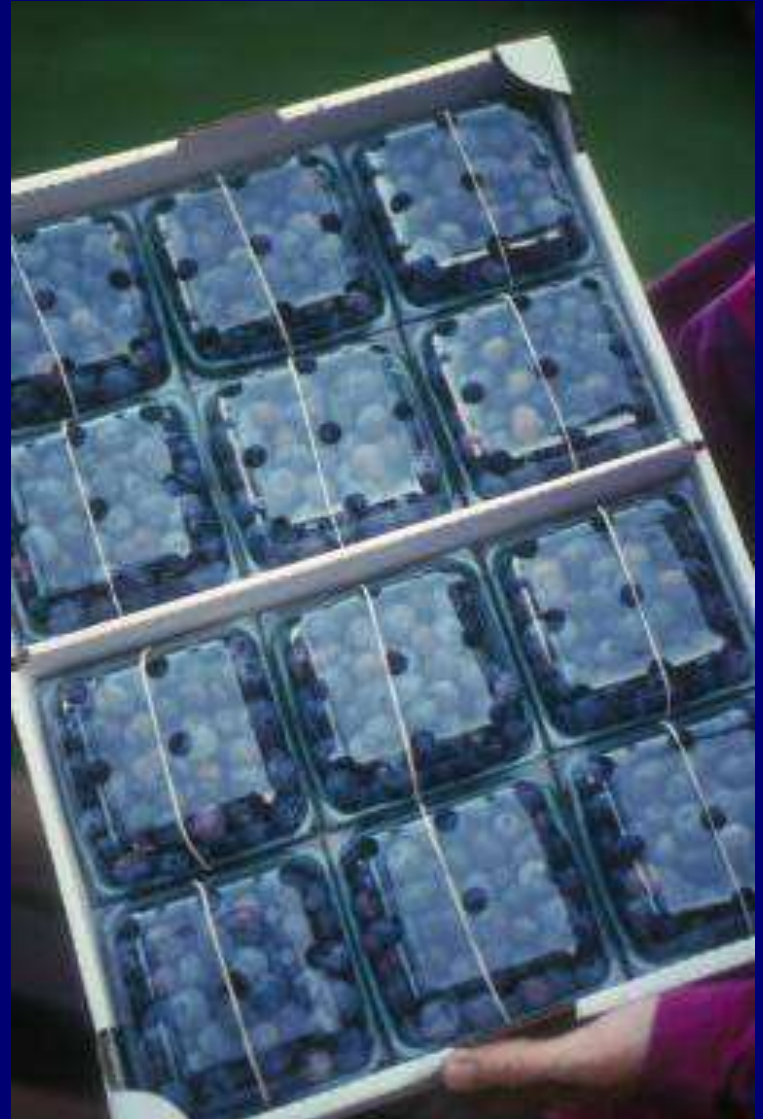
# Bird Netting Costs

**Table C. Bird Control Materials and Installation Costs for Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007**

Items	Amount	Units	Price (\$ Per Unit)	Total Cost (\$)
Net	23000	ft	0.1	2300
Post	115	each	10	1150
Wire	5000	ft	0.1	500
Materials, Cement and Other				250
Labor for Installation	10	hr	13.3	133
Total Costs for One Acre				4333
Total Costs for Ten Acres				43330



# Packing Blueberries



# Average Blueberry Yields

## 14,000 lbs/acre (7 tons)

**Table D. Estimated Annual Yield of Blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties**

Year	Number of Fruit Bearing Bushes Per Acre	Average Yield Pounds Per Bush	Total Yield Pounds Per Acre
2	1715	1	1715
3	1750	4	7000
Production	1750	8	14000



# Value of Blueberries

## ~ \$ 6.55/lb

**Table E. Los Angeles Terminal Market Prices for Imported Blueberries (January–May, 2005-2007), Percentage of Crop Harvested and Marketed, and Weighted Average Price**

Month	Price (\$/lb)			Average Price (\$/lb)	Percentage Share of Crop Marketed	Weighted Average Price (\$/lb)
	2005	2006	2007			
January	4.48	3.96	4.85	4.43	10	0.44
February	4.07	5.83	4.83	4.91	15	0.74
March	5.27	6.77	6.09	6.04	20	1.21
April	10.54	7.38	6.66	8.19	40	3.28
May	6.40	4.12	6.92	5.81	15	0.87
<b>Total</b>					<b>100</b>	<b>≈ 6.55</b>

**\$91,700 per acre GROSS**

# Blueberry Gross Income

## ~ \$ 91,700/acre

Table F. Estimated Annual Yield and Gross Income of Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

Year	Yield Pounds Per Acre	Gross Income (\$ Per Acre)
2	1,715	11,233
3	7,000	45,850
Production	14,000	91700

**Establishment costs = \$17,772/acre by the 3<sup>rd</sup> year**

**Grow cost = \$5,000/acre - - - Harvest cost \$49,000/acre**

**Overhead costs = \$6,800 (insurance, taxes, interest on investment, maintenance, etc.)**

**TOTAL COSTS = \$61,665/acre**



# Blueberries - Net returns based on price and yield

Price (\$ Per Pound)	Yield (Pounds per Acre)						
	9800	11200	12600	14000	15400	16800	18200
Net Returns Per Acre Above Total Costs at Varying Yield and Prices (\$)							
4.58	-1861	-422	1017	2455	3894	5332	6771
5.24	4608	6970	9333	11695	14058	16420	18783
5.89	10978	14250	17523	20795	24068	27340	30613
6.55	17446	21642	25839	30035	34232	38428	42625
7.21	23914	29034	34155	39275	44396	49516	54637
7.86	30284	36314	42345	48375	54406	60436	66467
8.51	36654	43594	50535	57475	64416	71356	78297

**\$97,000 - \$66,965 = \$30,035 per acre**



## Blueberry Clusters





# Enjoy



# Raspberries

- Types
- Varieties
- Soil Drainage
- Spacing
- Irrigation
- Fertility
- Pruning
- Pest Control





FAMILY: Rosaceae

GENUS: Rubus

SUBGENUS: Ideobatus

[Raspberries]

R. idaeus  
red & yellow



R. occidentalis  
black



R. neglectus  
purple



Eubatus

[Blackberries]



Erect types

Eastern trailing types

Southeastern trailing  
types

Western trailing types

Evergreen types



Aggregate fruit



Drupelet





# Red Raspberry Varieties

- Summer Bearing  
Earlier spring
- Fall Bearing  
June to October





# Summer-bearing cultivars

Canby - Medium to large, bright red, and firm. Susceptible to root rot.

Chilcotin - Large, bright red, firm. Productive but susceptible to root rot.

Chilliwack - Large, bright red, firm, excellent flavor, resistant to fruit rot.

Comox - Large, medium red, firm, fair flavor, and resistant to fruit rot.

Haida - Medium sized, firm, good flavor. Some root rot resistance.

Meeker – Medium to large, medium color, firm, good flavor.

Newburgh - Large, light red, medium firm; resistant to root rot.

Nootka – Med. sized, med. red, firm, productive; susceptible to root rot.

Skeena – Med. large, bright red, firm, good flavor, susceptible to root rot.

Sumner – Med. size and color, firm, excellent flavor. Most tolerant of wet soils.

Tulameen – Large, firm, excellent-flavored berries. High yielding.

Willamette – Large, dark red, firm, mild. Susceptible to root rot.

# Fall-bearing cultivars

- Amity** - Medium size and color, very firm, good flavor. Susceptible to root rot
- August Red** - Early maturing. Fruit is medium, bright red, soft, good flavor
- Autumn Bliss** – Large bright fruit, good flavor, very productive
- Bababerry** - Very large, soft, good production. Canes tolerant to summer heat.
- Caroline** – Very large, firm, productive, early, heat and wet tolerant
- Fall Red** - Fruit is small, red, fairly firm, good flavor. Vigorous and productive.
- Heritage** – Medium, red, very firm, attractive, very mild flavor. Sturdy canes.
- Indian Summer** - Very aromatic, crumbles frequently, good flavor, productive
- Jaclyn** – Very large, productive, early, good flavor.
- Polka** – *Large, productive, very good flavor – new variety*
- Redwing** – Ripe 2 weeks before Heritage. Med. size, firm, good flavor.
- September** - Medium, bright red, firm, attractive, good quality.
- Summit** - Matures about 10 days earlier than Heritage. Fruit is similar in size and firmness, but slightly darker.



# Black Raspberry Varieties

**Munger** - Fruit is small, blue-black, firm, good flavored and matures in July; canes are intolerant of wet soils.

**Bristol** - Inferior yield and quality compared to Munger; small black firm fruit – midseason

**Cumberland** - Inferior yield and quality compared to Munger. Small black fruit, good flavor.



# Gold Raspberry Varieties

- **Fall Gold** - Ripens ten days prior to Heritage. Fruit is yellow, moderately firm, very good flavor, with moderate to poor production. It often is virus infested.
- **Gold Harvest** – yellow colored Heritage
- **Kiwigold** – sport of Heritage from NZ
- **Anne** – Heritage season pale yellow





# Purple Raspberry Varieties

**Royalty** - Summer-bearing, very large, soft when fully ripe, fruit that is sweeter than Brandy wine. Highly productive. Suckers are produced from the roots like red raspberries.

**Brandywine** - Summer-bearing, large, round, reddish-purple, tart. Plant habit is similar to black caps, but more vigorous. No root suckers are formed. One of the best for pies.

**Amethyst** - Summer-bearing, fruit large, oval, purple with shiny skin, firm, excellent for desserts. No root suckers are formed. Very productive.

**Success** - Summer-bearing purple, sweet, good flavored fruit; vigorous canes.

			AVAILABLE AS	BERRY SIZE	FLAVOR	FIRMNESS	WINTER HARDINESS	ZONES
SUMMER BEARING	Early Season	Prelude*	BR	M-L	E	M	E	4-8
		Boyne	BR	M	E	M	E	3-7
	Early Mid-Season	Killarney	BR	M	G	F	E	4-7
		Lauren*	BR	VL	E	F	G	5-7
		TulaMagic®*	BR	L	G	F	G	5-7
	Mid-Season	Latham	BR	M	G	M	E	3-8
		Nova	BR	M-L	G	F	E	3-8
		Cowichan	BR	L	E	F	G	5-7
	Late Mid-Season	Encore*	BR	L	G	F	E	4-7
	Late-Season	Royalty Purple	NM	L	G	M	G	4-8
		Taylor	BR	M	E	F	G	4-8
		Octavia*	BR	M-L	G	F	G	5-7
	Yellow Raspberries	Anne*	BR	L	E	F	E	4-7
FALL BEARING	Everbearing Red Raspberries	Polana*	BR	M-L	G	F	E	3-8
		Jaclyn*	BR	L	E	F	G	4-8
		Joan J*	BR	L	G	F	E	4-8
		Autumn Britten*	BR	L	E	F	G	4-8
		Polka*	BR	L	G	V	G	4-8
		Himbo-Top®*	BR	VL	G	F	G	4-8
		BP-1*	BR	L	E	F	G	4-8
		Caroline*	BR	M-L	E	M	E	4-7
		Heritage	BR	M-L	G	F	E	4-8
		Josephine*	BR	VL	E	F	F	5-7
		Nantahala*	BR	M-L	E	F	F	6-10

R  
a  
s  
p  
b  
e  
r  
r  
y



# New Growers in Sebastopol





# Magana – Polka - Caroline





# John Guardino's Raspberries





# Soil for Raspberries

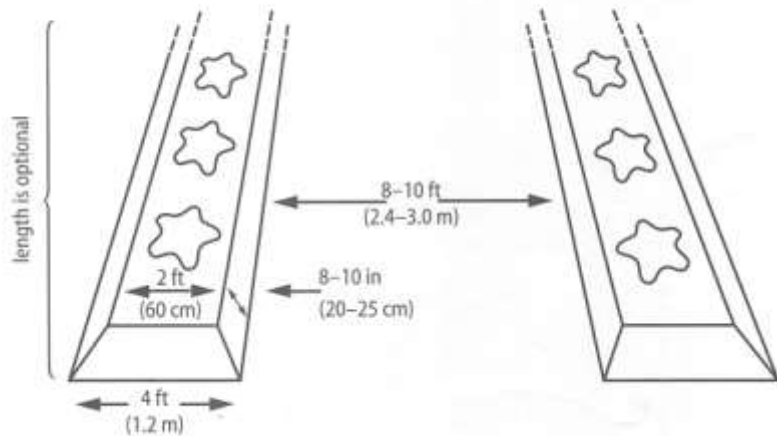
- Deep – 3 to 6 feet
- Well drained – sandy or gravel

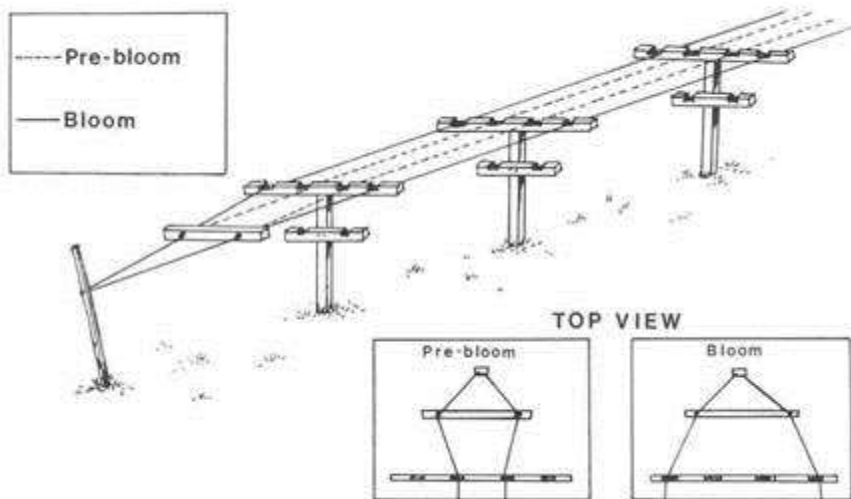
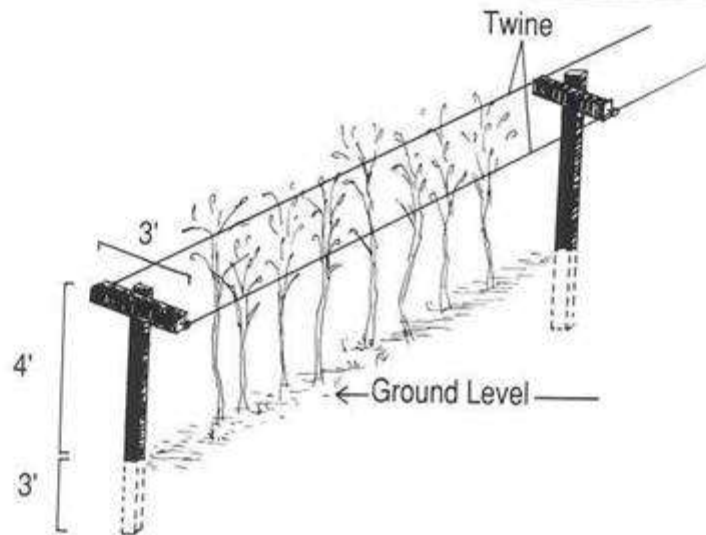




**Raspberries  
must be planted  
on raised beds  
space 1' x 10'**

Approximate dimensions of cane and bush berry raised beds.









**Three wire raspberry trellis**











# Raspberries – Narrow Trellis





# Narrow Trellis - Raspberry







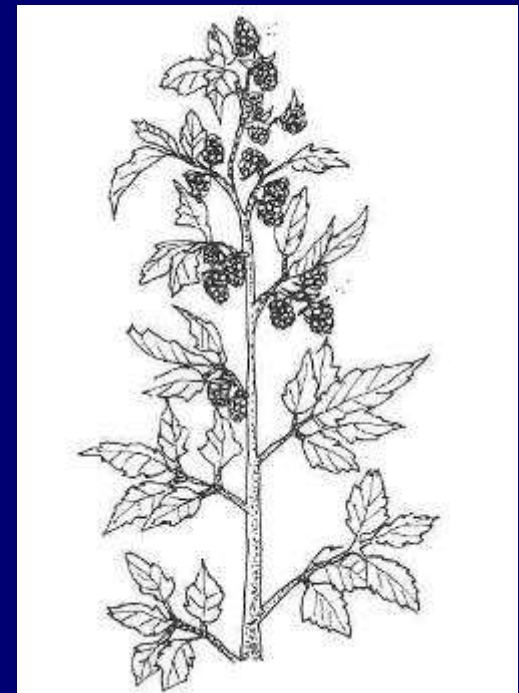
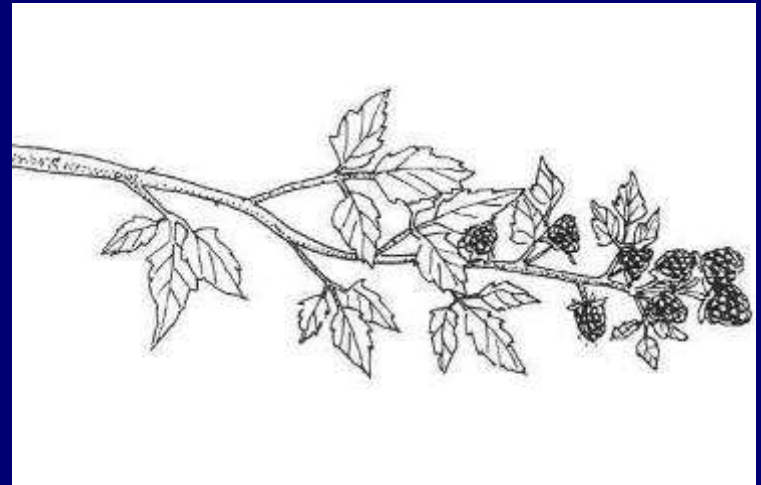
**Floricanes  
from last year**

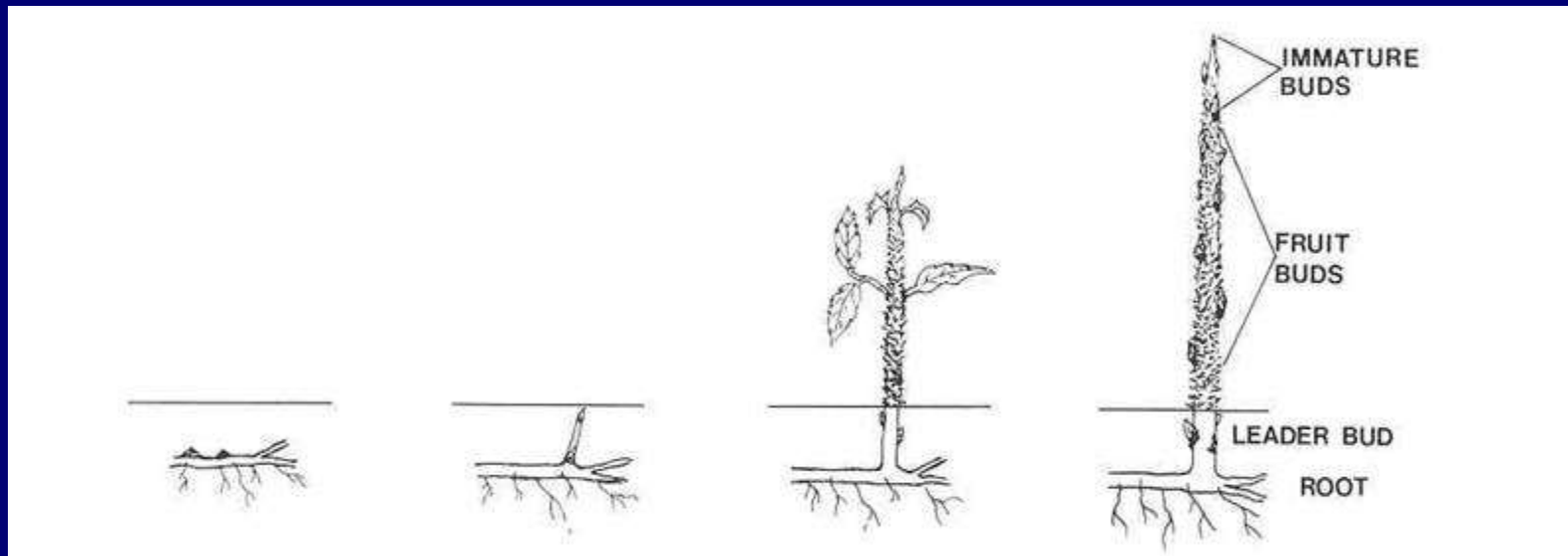
**Primocanes  
from this year**



# Raspberry

Bearing from laterals  
off floricanes and from  
tips of primocanes later

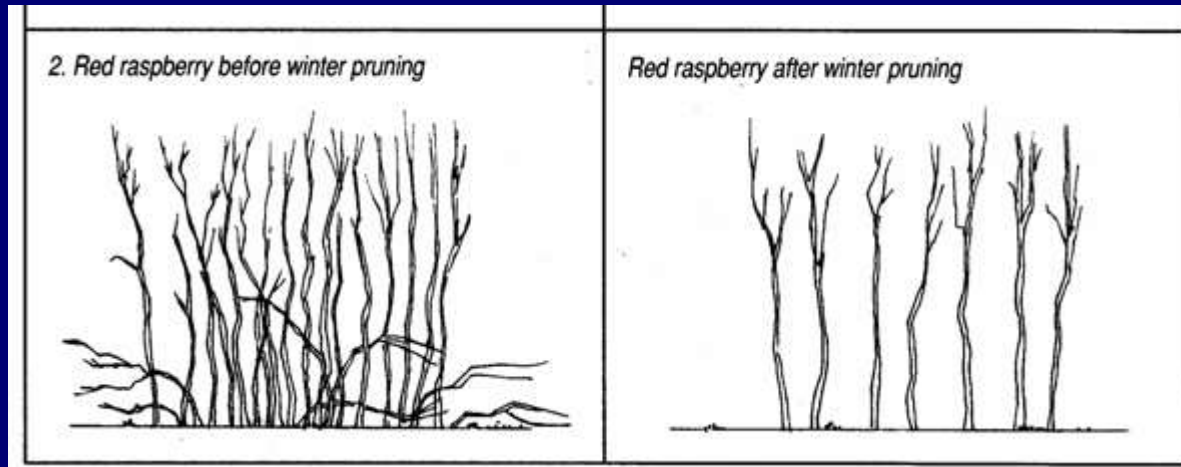




**Root suckers  
=  
primo-canes**



# Overwinter = flori-canes





A photograph of a flowering plant with numerous tall, slender, light-colored stems (primocanes) rising from a dense, low-lying green foliage. The stems are thin and appear to be in the early stages of flowering, with some small, light-colored buds visible at the tips. The background is a soft-focus outdoor setting with more greenery and a hint of a path.

**Earlier bearing  
from  
floricanes and  
later from  
primocanes**

A photograph of a flowering plant in a dormant or late-season state. The stems are mostly dry, brown, and broken, lying on the ground. Some green foliage is still visible at the base of the plant. The ground is covered with dry leaves and twigs, suggesting a late autumn or winter setting.

**Fall bearing  
from  
primocanes**



# High Production Raspberries









# Raspberry Problems





# Raspberry root rot







**What is this ?**

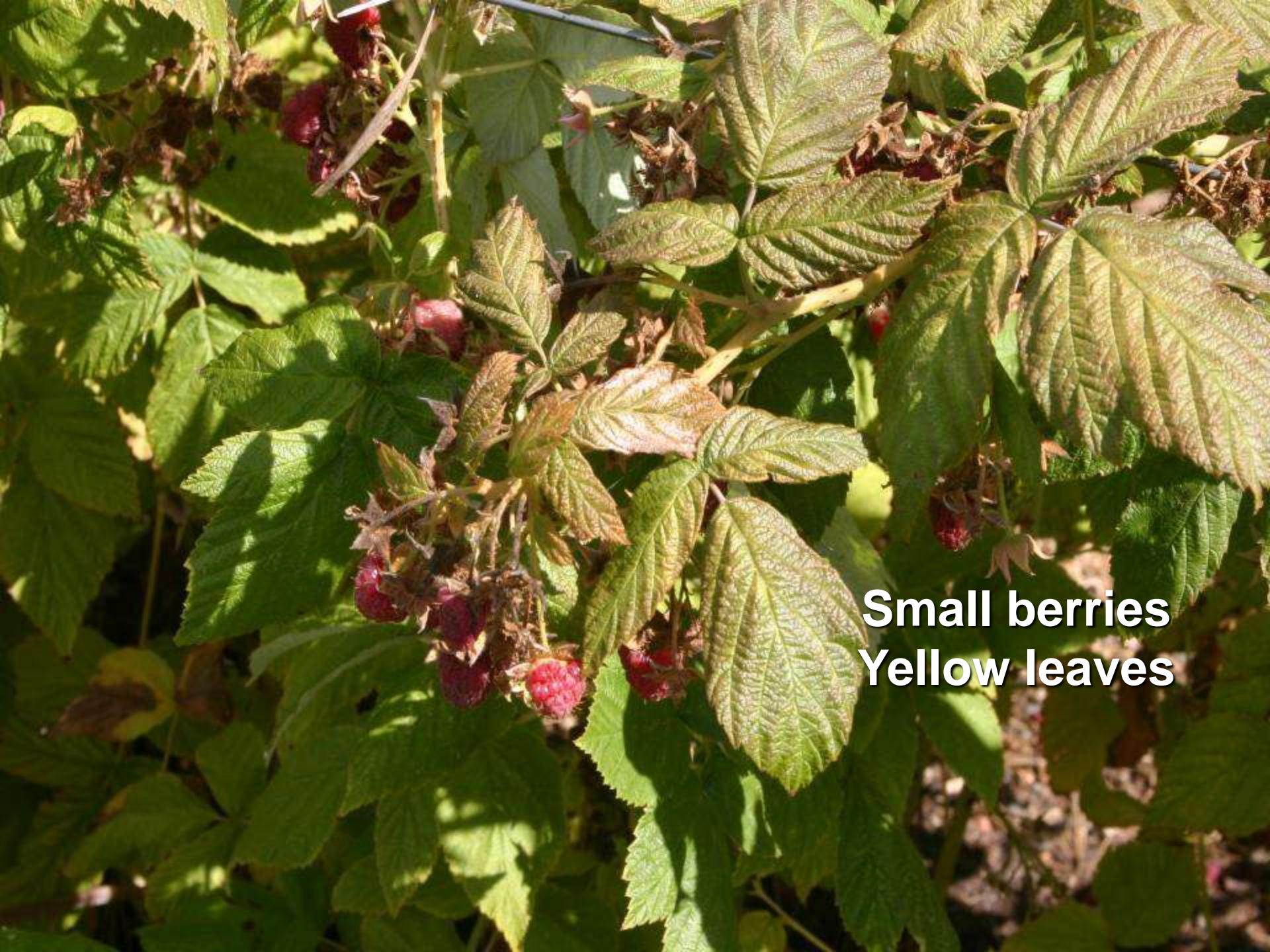






**Improper irrigation**



A close-up photograph of a raspberry plant. The leaves are mostly green but show significant yellowing and browning, particularly along the veins and edges, indicating a nutrient deficiency or disease. Several small, dark red raspberries are visible, some in clusters and others individually. The lighting is bright, casting shadows on the leaves.

**Small berries**  
**Yellow leaves**















# Mite control

**No water stress**

**Avoid dusty conditions**

**Spray water with garden hose**









# Raspberries don't like weeds





# Raspberry virus





**Crumbly berry = virus**



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**UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION**

---

**2005**

**SAMPLE COSTS TO PRODUCE  
FRESH MARKET  
RASPBERRIES**



**Central Coast Region**

Santa Cruz and Monterey Counties



# NET RETURNS PER ACRE ABOVE OPERATING COSTS

PRICE (\$/flat)	YIELD (flats/acre)						
Fresh	1,500	2,000	2,500	3,000	3,500	4,000	4,500
8.00	-1,500	-943	-385	171	729	1,285	1,843
10.00	1,500	3,057	4,615	6,171	7,729	9,285	10,843
12.00	4,500	7,057	9,615	12,171	14,729	17,285	19,843
14.00	7,500	11,057	14,615	18,171	21,729	25,285	28,843
16.00	10,500	15,057	19,615	24,171	28,729	33,285	37,843
18.00	13,500	19,057	24,615	30,171	35,729	41,285	46,843
20.00	16,500	23,057	29,615	36,171	42,729	49,285	55,843

# NET RETURNS PER ACRE ABOVE CASH COSTS

PRICE (\$/flat)	YIELD (flats/acre)						
Fresh	1,500	2,000	2,500	3,000	3,500	4,000	4,500
8.00	-4,368	-3,811	-3,253	-2,697	-2,139	-1,583	-1,025
10.00	-1,368	189	1,747	2,203	4,861	6,417	7,975
12.00	1,632	4,189	6,747	9,303	11,861	14,417	16,975
14.00	4,632	8,189	11,747	15,303	18,861	22,417	25,975
16.00	7,632	12,189	16,747	21,303	25,861	30,417	34,975
18.00	10,632	16,189	21,747	27,303	32,861	38,417	43,975
20.00	13,632	20,189	26,747	33,303	39,861	46,417	52,975

# NET RETURNS PER ACRE ABOVE TOTAL COSTS

PRICE (\$/flat)	YIELD (flats/acre)						
Fresh	1,500	2,000	2,500	3,000	3,500	4,000	4,500
8.00	-8,290	-7,733	-7,175	-6,619	-6,061	-5,505	-4,947
10.00	-5,290	-3,733	-2,175	-619	939	2,495	4,053
12.00	-2,290	267	2,825	5,381	7,939	10,495	13,053
14.00	710	4,267	7,825	11,381	14,939	18,495	22,053
16.00	3,710	8,267	12,825	17,381	21,939	26,495	31,053
18.00	6,710	12,267	17,825	23,381	28,939	34,495	40,053
20.00	9,710	16,267	22,825	29,381	35,939	42,495	49,053

Raspberry

Central  
Coast

2005

~ \$6,000  
per acre to  
establish

# Types of Costs

- **Operating Costs**: Pruning, fertilizer, irrigation, harvest, cooling, packing
- **Cash Costs**: Insurance, office, sanitation, rent, taxes
- **Total Costs**: Capitol recover, building maintenance, equipment, irrigation pipe, pump and well





# Covered Raspberry Production

- New York Study 1999
- Compared Greenhouse vs. outdoor
- Greenhouse: Fruited Feb-April
- Harvested: 9.5 tons/acre
- Retail Value: \$3-6/½ pint (\$142,000/acre)
- Outdoor : July-Sept.
- Harvested 10.5 tons/acre
- Retail Value: \$2/½ pint (\$36,000/acre)



# Enjoy





# Blackberries

- Types
- Varieties
- Soil Drainage
- Spacing
- Irrigation
- Fertility
- Pruning
- Pest Control





**Logan**



**Wild**

# Wild Blackberries



Evergreen - *Rubus laciniatus*

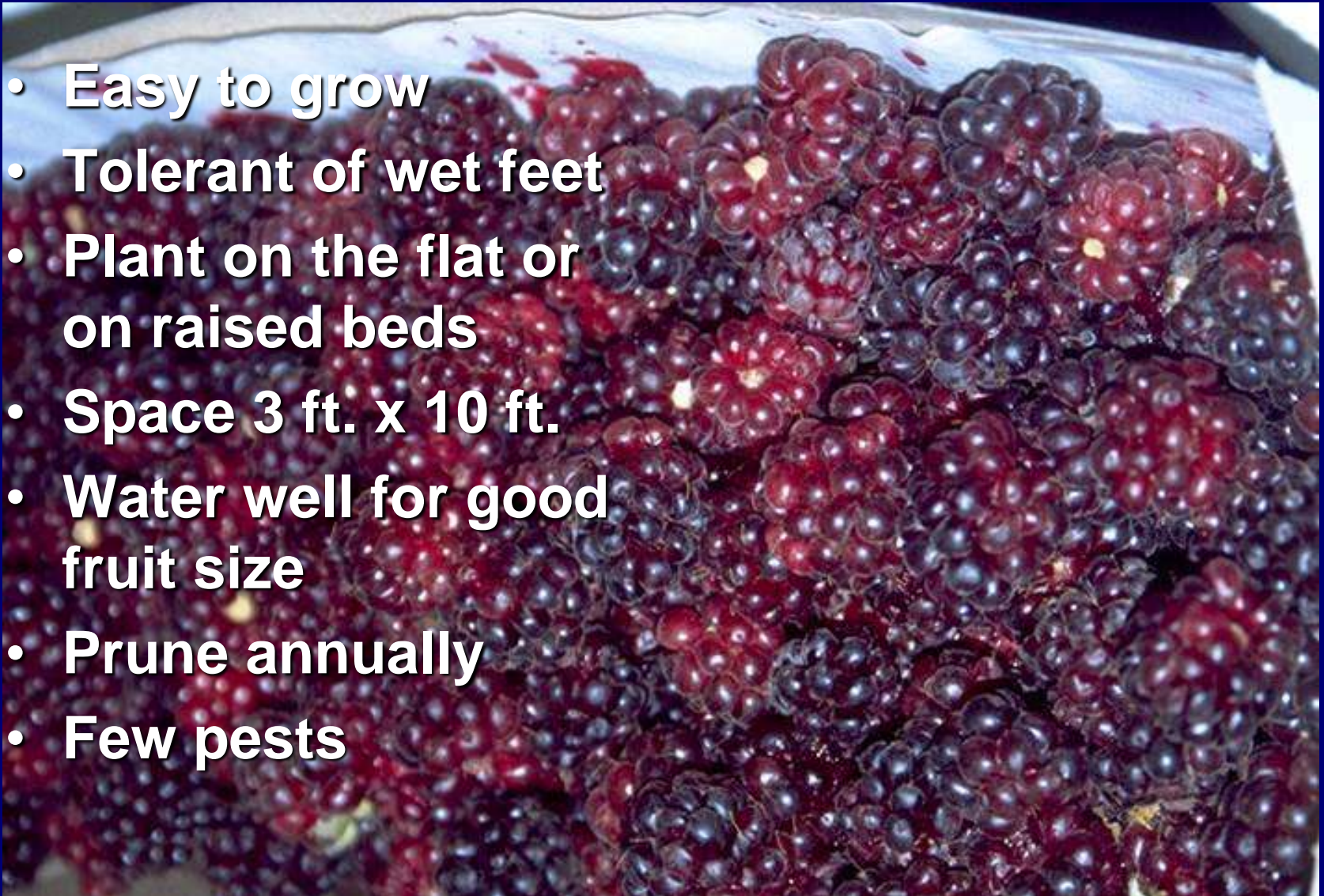


Himalayan - *Rubus discolor*



# Growing Blackberries

- Easy to grow
- Tolerant of wet feet
- Plant on the flat or on raised beds
- Space 3 ft. x 10 ft.
- Water well for good fruit size
- Prune annually
- Few pests





# Trailing and Erect Blackberries



**Space 3 ft. x 10 ft.**



# Erect Blackberries

**Black Satin:** Mid-season; large, shiny black, tart flavor, thornless, vigorous.

**Cherokee:** Mid-season; medium large, firm, vigorous, thorny; tolerates heat.

**Cheyenne:** Early; very large, firm, vigorous, thorny, tolerates heat.

**Chester:** Late; large, tart, thornless, very productive.

**Darrow:** Vigorous, thorny, productive, large glossy fruit.

**Hull:** Vigorous, thornless, sweet excellent flavor.

**Shawnee:** Mid-season, very large, firm, vigorous, thorny, very productive; tolerates heat

# Trailing Blackberries

Boysen (Nectar Berry): Mid-season; very large, deep maroon, soft, excellent distinct flavor; canes thorny, but thornless types available; tolerates heat.

Kotata: Mid-season; berries large, firm, good flavor, thorny, vigorous, productive.

Logan: Early; medium size, long, dark red, soft, excellent, unique flavor; thornless

Marion: Mid-season; large, bright black, firm, excellent flavor, thorny, productive.

Ollalie: Mid-season; large, bright black, firm, good flavor, vigorous, productive.

Silvan: Early, large, firm, excellent flavor, thorny, productive.

Tayberry: Early; large, medium red, soft, flavor distinctive, thorny.

Thornless Evergreen: Late; medium, firm, mild flavor, productive.

Waldo: Mid-season; medium size, firm, mild flavor, thornless, productive.

Young: Mid-season; very large, maroon, sweet, excellent flavor.



# John Guardino's Boysenberries





# New Variety

HORTSCIENCE 49(8):1108–1112. 2014.

## ‘Columbia Star’ Thornless Trailing Blackberry

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*Additional index words.* fruit breeding, ‘Lincoln Logan’ thornlessness, machine harvest, processing, small fruit

‘Columbia Star’ is a new thornless, trailing blackberry (*Rubus* subg. *Rubus* Watson) cultivar from the U.S. Department of Agriculture–Agricultural Research Service (USDA-ARS) breeding program in Corvallis, OR, released in cooperation with the Oregon State University’s Agricultural Experiment Station. ‘Columbia Star’ is the

first thornless blackberry to be released with the ‘Lincoln Logan’ source of thornlessness other than the original ‘Lincoln Logan’ and ‘Waimate’ that have ‘Logan’-type fruit and ‘Marahau’ that has ‘Boysen’-type fruit (Hall et al., 1986; Hall and Stephens, 1999; Fig. 1). ‘Columbia Star’ is introduced as a very high-quality, high-yielding, machine-harvestable, thornless trailing blackberry with firm, sweet fruit that when processed are similar in quality to or better than fruit from the industry standards ‘Marion’ and ‘Black Diamond’. ‘Columbia Star’ should be adapted to areas where other trailing blackberries can be grown successfully. The name recognizes the importance of the Columbia River in the geography and history of the Pacific Northwest.

Ltd.). The background of ‘Columbia Star’ is extremely diverse (Fig. 1). ‘Marion’ accounts for 20% of the background of ‘Columbia Star’ based on pedigree. The two immediate parents represented elite selections from the New Zealand and Oregon breeding programs. ORUS 1350-2 is thorny, very productive, and vigorous with very large, uniformly shaped barrel fruit that were prone to heat damage and had only fair flavor. NZ 9629-1 was thornless, very productive, and vigorous with small to medium-sized outstanding flavored, uniformly shaped, conic fruit that tended to have visually noticeable pubescence on the fruit that consumers mistake for fruit rot (*Botrytis cinerea* Pers.:Fr.). ‘Columbia Star’ is the first named commercial blackberry-type (vs. ‘Logan’- or ‘Boysen’-type) cultivar to be released using the ‘Lincoln Logan’ source of thornlessness, which was developed originally by The New Zealand Institute for Plant and Food Research Ltd. from a somaclonal selection derived from a thornless sport of ‘Logan’ (Hall et al., 1986; H. Hall, personal communication, J. Stephens, personal communication).

‘Columbia Star’ was evaluated most extensively in trials at Oregon State University’s North Willamette Research and Extension Center (OSU-NWREC; Aurora, OR), USDA-ARS (Corvallis, OR), and at Enfield Farms Inc. (Lynden, WA). In each of the Oregon trial plantings, standard cultural practices for trailing blackberry production were used, including annual pre- and post-emergent herbicide applications, spring nitrogen fertilization (78 kg N/ha), post-harvest removal of floricanes, training of primocanes to a two-wire trellis, and application of 2.5 to 5.0 cm of irrigation during the growing season, depending on rainfall. Delayed dormant applications of liquid lime sulfur and copper hydroxide were made to control leaf and cane spot caused by *Septoria rubi* Westend, purple blotch caused by *Septocysta ruborum* (Lib) Petr., rust caused by *Kuehneola uredinis* (Link) Arth., and anthracnose caused by *Elsinoe veneta* [Burkholder] Jenk. as a standard practice without any knowledge of the susceptibility of the selections in trial to these diseases. The cooperating grower in Washington is primarily a red raspberry (*Rubus idaeus* L.) grower and although plants were spaced and trained similarly to those in the Oregon trials, they were irrigated and received N fertilizer rates that were standard for red raspberry but greater than that typical for blackberry. At OSU-NWREC, ‘Columbia Star’ was planted in 2009 along with other

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This research was funded by the Oregon Raspberry and Blackberry Commission, a grant through the Northwest Center for Small Fruits Research, and USDA-ARS CRIS projects numbers 5358-21220-002-00D and 5358-21000-047-00D.

We gratefully acknowledge Connie Pace, Nino Adams, Kimmie Ernst, and Gil Buller for their assistance in the evaluation of ‘Columbia Star’.

Origin



# Primo-cane blackberry

PrimeArk – 45 and PrimeArk Freedom





# Tip pruning > force branching to increase fruiting branches and yield.

- *Timing is important  
earlier is better once 18" tall  
"hard" tipping may offer additional advantages? - timing*
- *When? - Repeat later?*





# Primocane blackberry – cut back





# Primocane blackberry – cut back and re-growth





# Primocane blackberry – regrowth





# Primocane blackberries





# Total Seasonal Berry Yield (marketable)

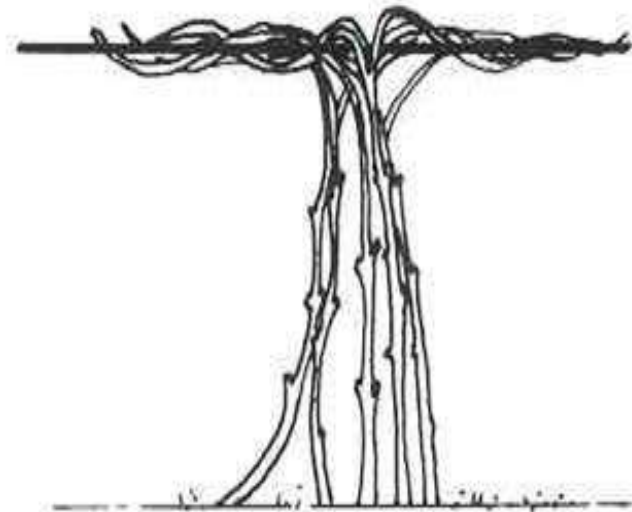
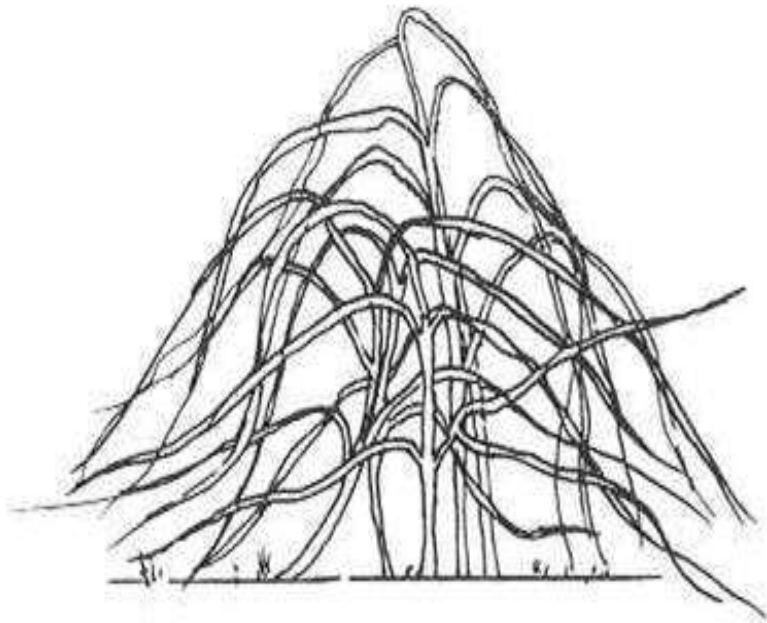
Pruning Treatment	Yield (lb / acre)
January mow / no tip	8,960
January mow 18" tip	8,481
January mow 18" tip + 50" tip	10,469
March mow / no tip	7,697
March mow /18" tip	9,530
March mow / 18" tip + 50" tip	8,518
May mow / no tip	5,762
May mow / 18" tip	6,392
May mow / 18" + 50" tip	6,358

# Blackberry Trellis System





# Pruning Erect Blackberries





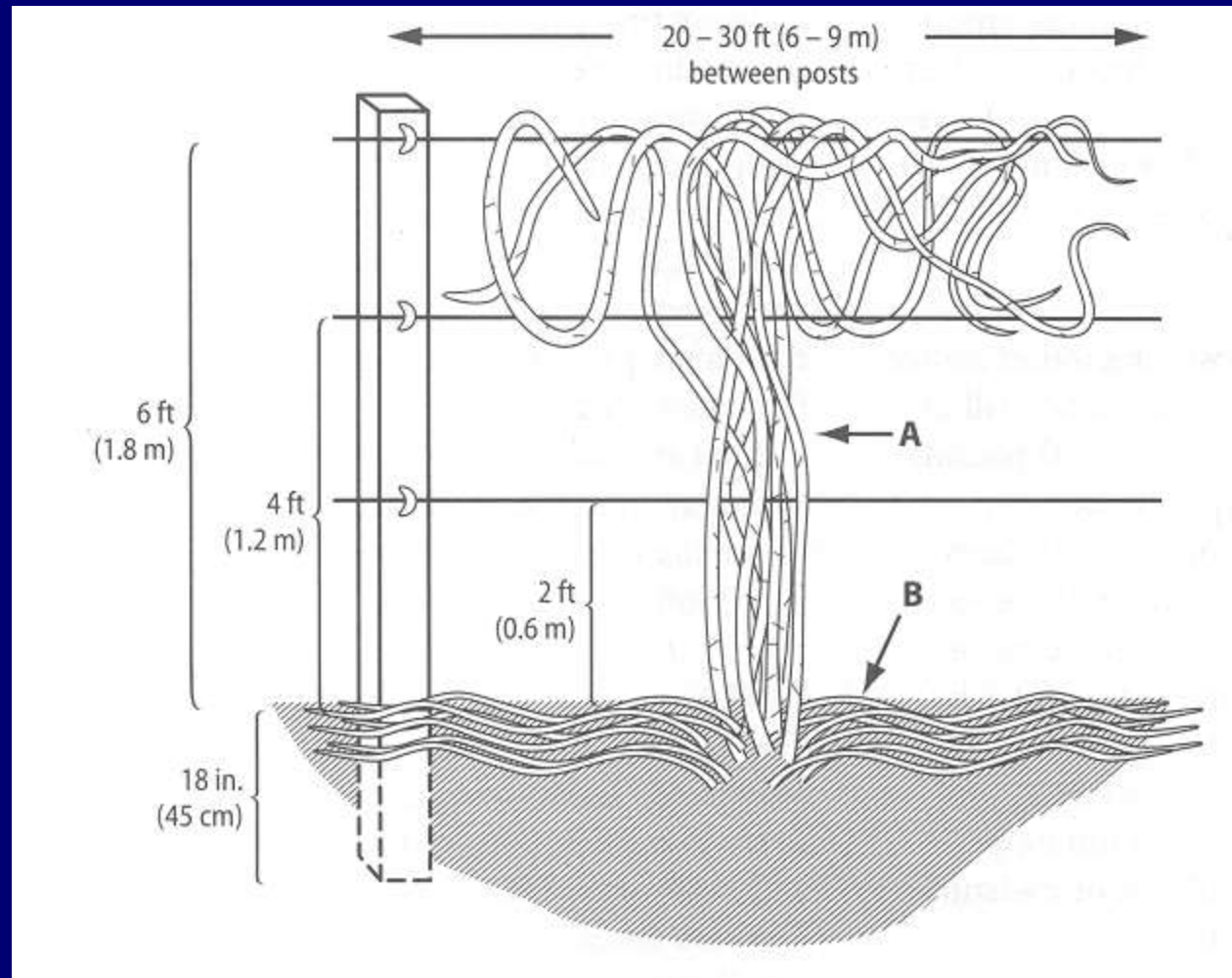
## Pruning Erect Blackberries

- Remove last year's canes
- Wrap this year's canes on wires





# Pruning Trailing Blackberries







# New growth & last year's growth









# Blackberry flower









# Blackberry Problems













# Blackberry Harvest





# Boysenberries





# Blackberries 2008

## Net Returns above TOTAL Costs

PRICE (\$/flat)	YIELD (flats/acre)						
Fresh	2,500	3,000	3,500	4,000	4,500	5,000	5,500
10.00	-1,380	148	1,679	3,213	4,746	6,281	7,818
11.00	1,120	3,148	5,179	7,213	9,246	11,281	13,318
12.00	3,620	6,148	8,679	11,213	13,746	16,281	18,818
13.00	6,120	9,148	12,179	15,213	18,246	21,281	24,318
14.00	8,620	12,148	15,679	19,213	22,746	26,281	29,818
15.00	11,120	15,148	19,179	23,213	27,246	31,281	35,318
16.00	13,620	18,148	22,679	27,213	31,746	36,281	40,818

Establishment costs = \$9,600/acre - - Production costs = \$33,000/acre

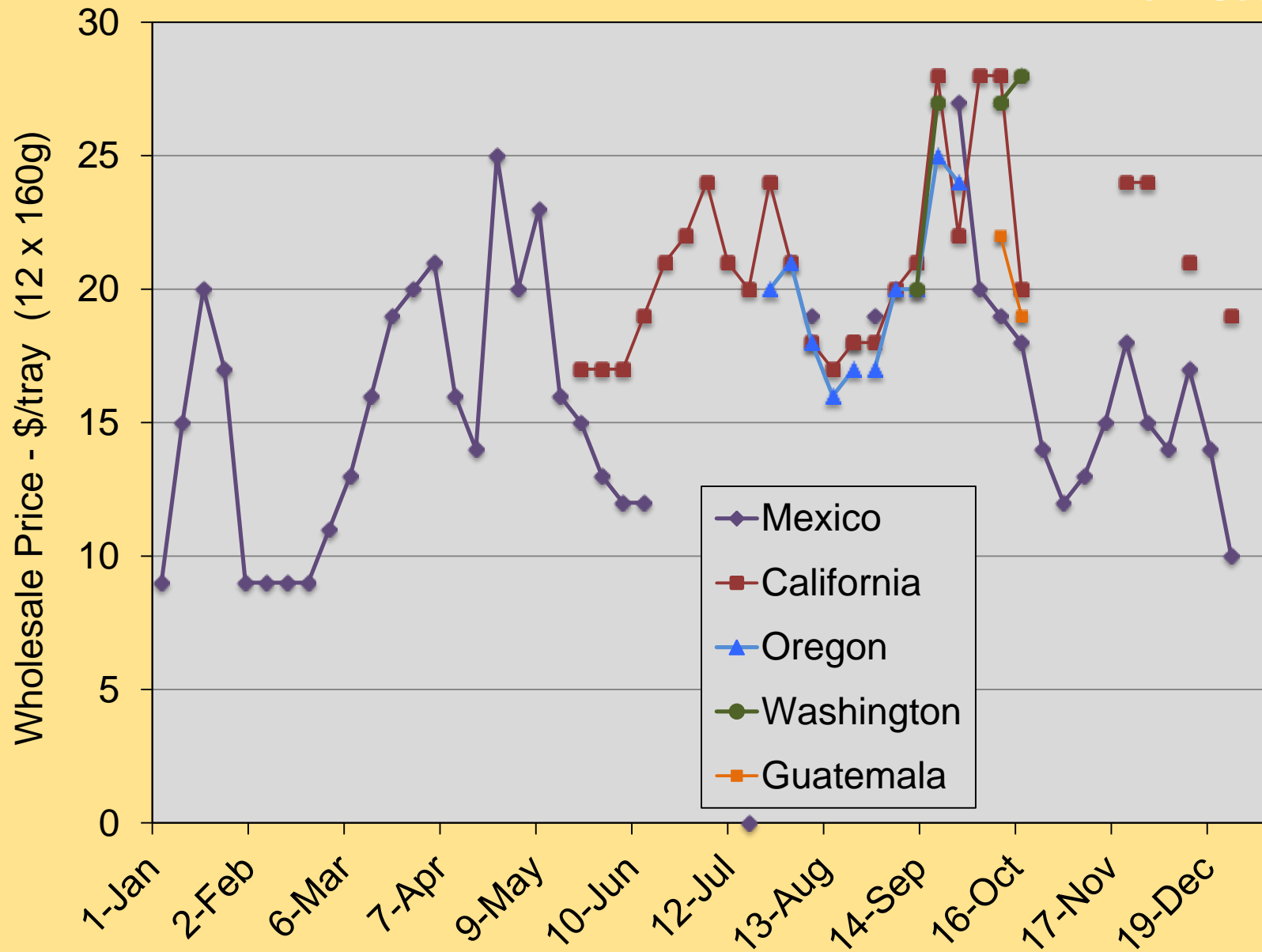
Ave. Yield = 3,500 flats (7.9 tons/acre) - - - Ave. Price = \$14/flat

**TOTAL NET (Gross – Cost) = \$15,679/acre**



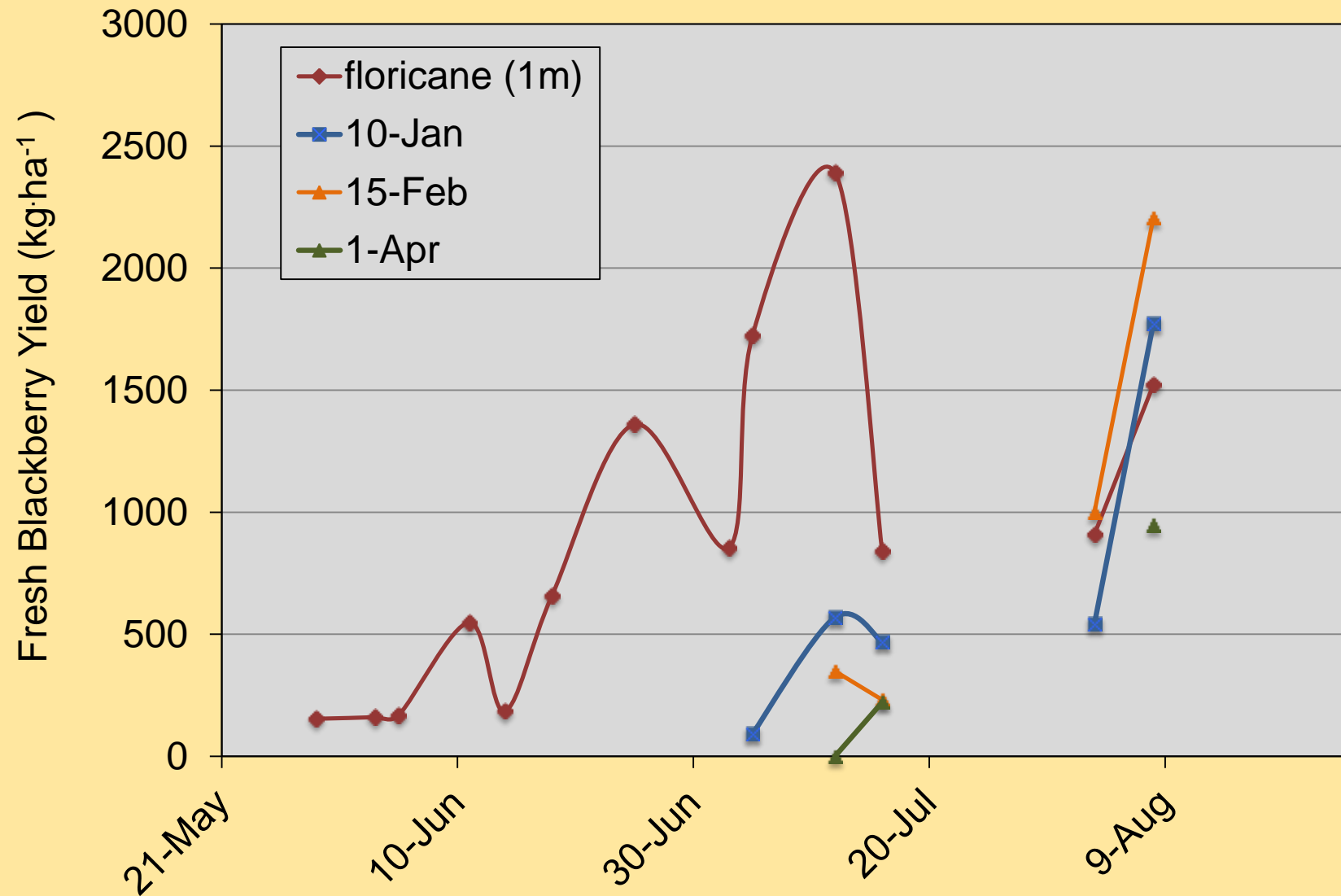
*Weekly wholesale price for fresh blackberries  
Los Angeles Terminal Market - 2014*

Mark Gaskell



*Floricanne VS primocane fresh blackberry harvest timing – tunnels*  
*Santa Maria, CA - 2013*

Mark Gaskell





# Enjoy





# Strawberries

- Physiology - Types (SD – DN)
- Varieties
- Systems
- Soil
- Spacing
- Irrigation
- Fertility
- Pests





42°N

# California

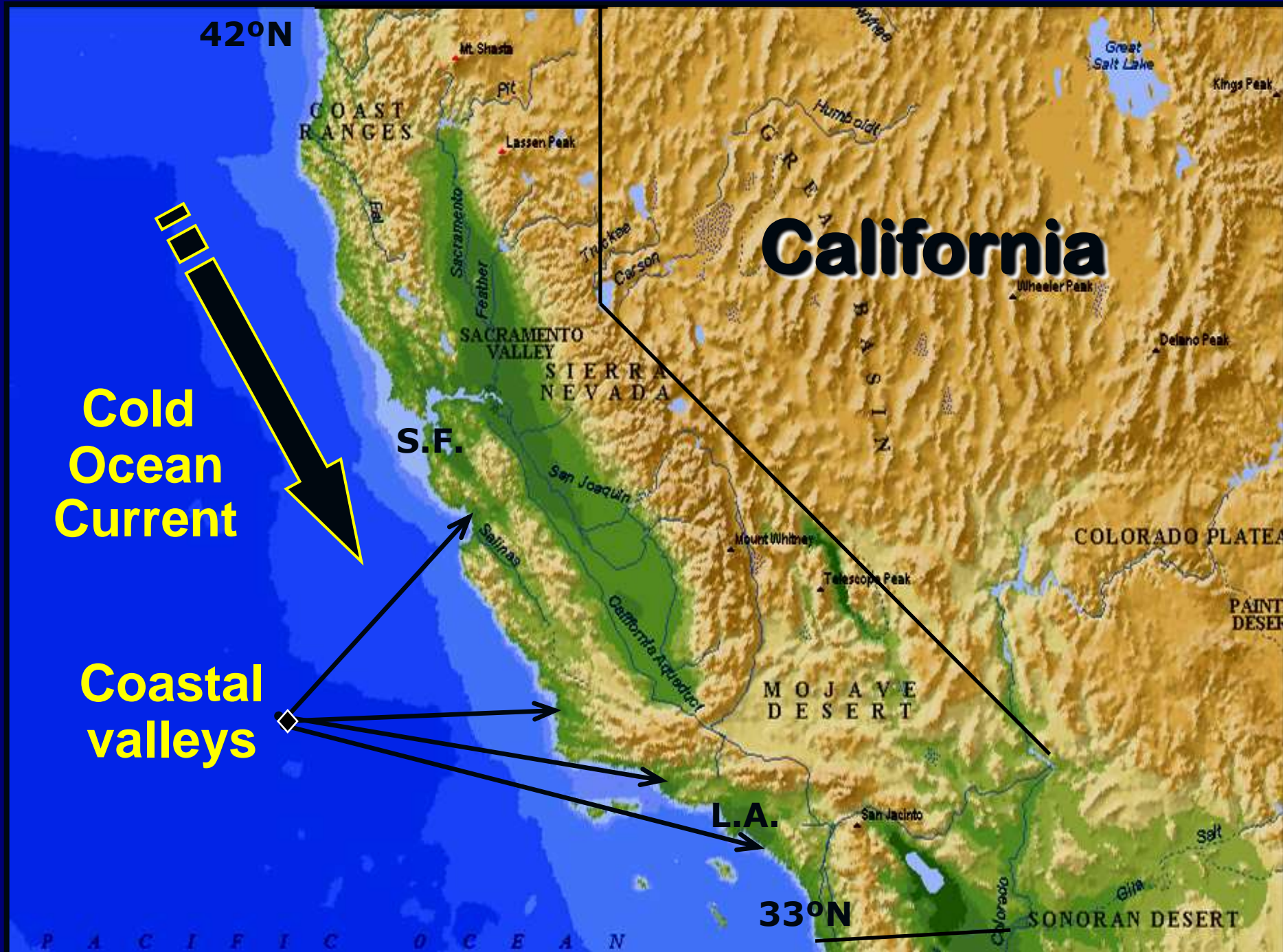
**Cold  
Ocean  
Current**

**Coastal  
valleys**

S.F.

L.A.

33°N





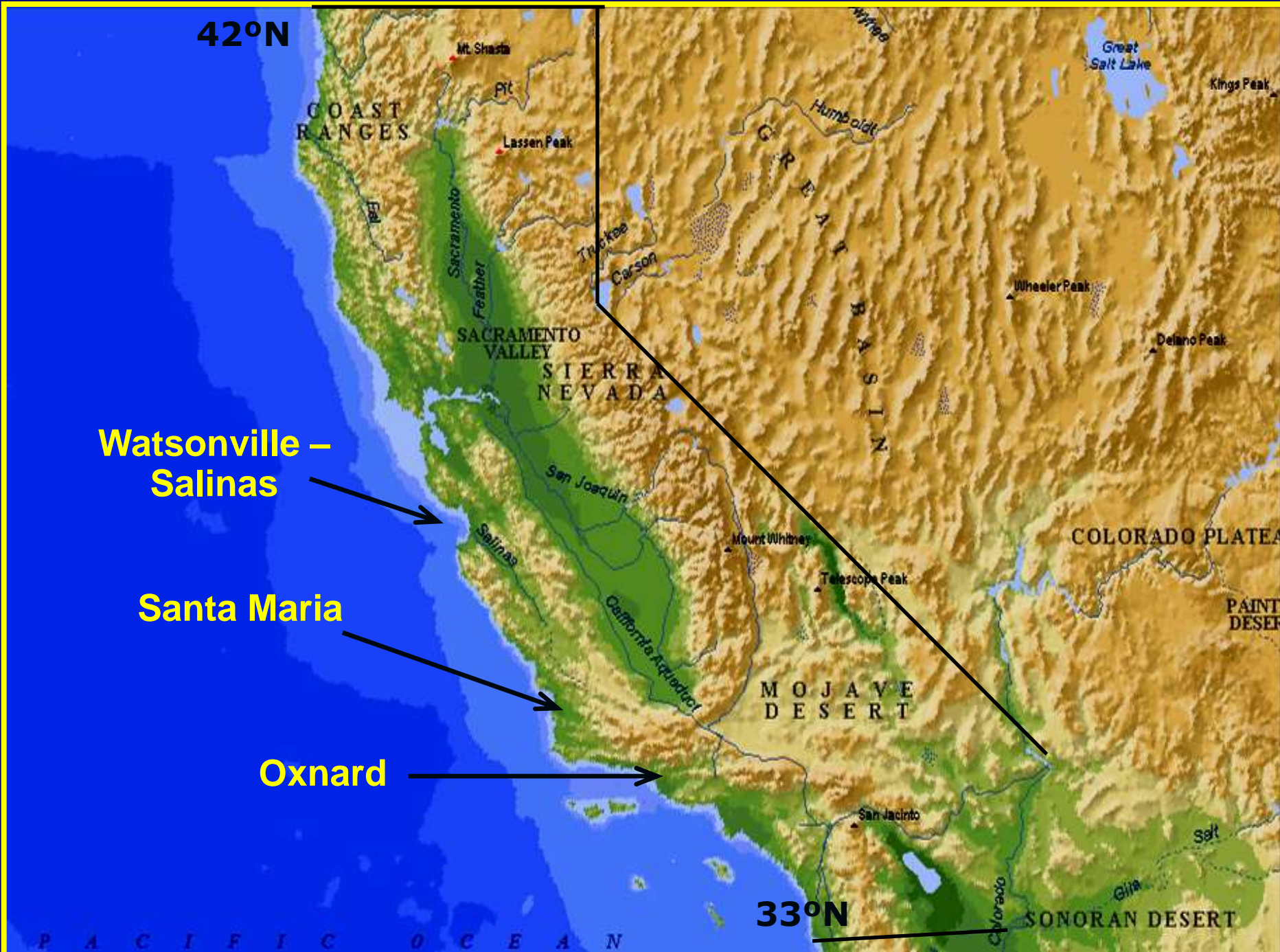
42°N

Watsonville –  
Salinas

Santa Maria

Oxnard

33°N





# Strawberry Physiology

- Day length: response to light = vegetative growth (runners) or fruit production (12 hrs)
  - Temperature: below  $\sim 10^{\circ}\text{C}$  = poor growth and fruit production;  $\sim 12^{\circ}\text{C}$  to  $24^{\circ}\text{C}$  = fruit; above  $\sim 24^{\circ}\text{C}$  = no fruit. Dominant over day length
  - Chilling: hours below  $7^{\circ}\text{C}$  – affects vigor, yield, and fruit quality (supplemental @  $1^{\circ}\text{C}$ )
- 
- Drought stress: can induce fruiting
  - Plant leaves and size: amount of leaf removal and plant size affects productivity

# Two basic flowering types

1. Short-day (SD)
2. Day-neutral (DN)  
(everbearer)



## Plants of short-day varieties flower:

- Light period  $< \sim 13$  hours
- Low temperature ( $< 24^{\circ}\text{C}$ )

## Plants of day-neutral varieties flower:

- Summer (regardless of day length)
- High temperatures ( $> 24^{\circ}\text{C}$ )
- but best quality and greatest yield with moderate temps



# Planting Dates

## Short Day - Spring Bearing

- August to September
- From cold storage
- New plants = large size fruit and firm fruit

## Day Neutral - Everbearing

- Early Spring
- From cold storage
- New plants = large size and firm fruit

# Modern Strawberry System

- Well drained
- Sandy soil
- Raised beds
- Plastic mulch
- Drip irrigated
- Good varieties
- Good plants





# CHARACTERISTICS OF CALIFORNIA STRAWBERRY CULTIVARS

Cultivar	Day length	Planting season	Area	Supp. storage <sup>2</sup>	Fruit characteristics	Plant characteristics	Susceptibility to pests
Albion	DN	fall	CC	10 days to 2.5 weeks	large; excellent flavor; red internal and external color	Mod. vigorous plant; high productivity, very long season; avoid overchilling, or will runner excessively	tolerant of major soil pathogens; moderately susceptible to powdery mildew
Aromas	DN	fall	CC	10 days to 3 weeks	medium size; dark red color; good flavor	very high yields; long production season	misshapen fruit occasionally a problem, in early season; tolerant of root and crown diseases
Camarosa	SD	fall	CC, SC	none to 1 week	large; good flavor; excellent shelf life; good for fresh market and freezer pack; resistant to rain damage	vigorous plant; high-yielding; early production; adapted to early fall planting	tendency to produce misshapen fruit; susceptible to <i>Verticillium</i>
Camino Real	SD	fall	CC	7 to 14 days	large; very good flavor; highly tolerant of rain damage	not early; compact plant that needs adequate nursery chilling; good cultivar for Santa Maria Valley	sensitive to sulfur sprays; relatively tolerant to <i>Phytophthora</i> and <i>Verticillium</i>
Chandler	SD	summer	SJV	NA	medium size; very good flavor; tender skin; soft when temps. are high	moderate yields	—
Diamante	DN	fall	CC, SC	10 days to 3 weeks	large; very good flavor; light color; sensitive to rain damage	moderately vigorous plant; high productivity; long season, open canopy, easy harvest	highly susceptible to <i>Phytophthora</i>
Palomar	DN	fall		?	Large; excellent flavor, good color, sensitive to calyx spot		
Ventana	SD	fall	CC, SC	none to 1 week	large; good flavor; good color but lighter than Camarosa; resistant to rain damage	vigorous plant with heavy early production; adapted to early fall planting; sets well in adverse weather; excellent for winter-spring fresh market	susceptible to <i>Phytophthora</i> root and crown rot; fruit is susceptible to powdery mildew

## Newest Varieties

# Short-day cultivars

**Camarosa** - large; good flavor; excellent shelf life; good for fresh market and freezer pack; resistant to rain damage; vigorous plant; high-yielding; early production; adapted to early fall planting; 0-1 week chilling; produces misshapen fruit; susceptible to *Verticillium*

**Camino Real** - large; very good flavor; highly tolerant of rain damage; not early; fall plant, compact plant that needs 7-14 days of chilling; good cultivar for interior valleys; sensitive to sulfur sprays; tolerant to *Phytophthora* and *Verticillium*

**Chandler** - medium size; very good flavor; tender skin; soft when temps. are high; moderate yield; 0 chilling, summer plant

**Ventana** - large; good flavor; good color but lighter than Camarosa; resistant to rain damage; vigorous plant with heavy early production; adapted to early fall planting; sets well in adverse weather; excellent for winter-spring fresh market; 0-1 week chilling; susceptible to *Phytophthora* root and crown rot; fruit is susceptible to powdery mildew

**Douglas** – Old variety - large, good color and good flavor

**Pajaro** - Old variety - large, dark red color.

**Oso Grande** - Old variety - high yield, large, good flavor.

**Sequoia** - Old variety - large soft fruit with excellent flavor. Plants are resistant to *Verticillium* wilt.

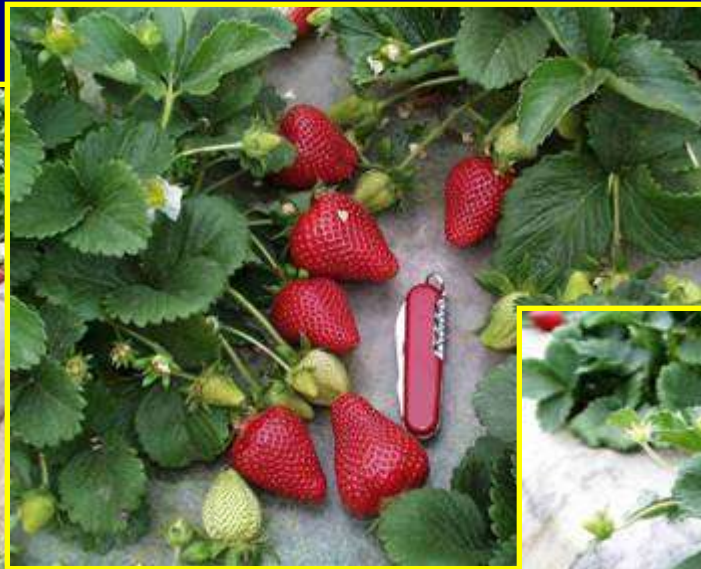




**Ventana**

**Camarosa**





# Camarosa





**Chandler**



**Short Day**



# Day-neutral varieties

Albion - large; excellent flavor; red internal and external color; mod. vigorous plant; high productivity, very long season; 10-18 days chilling; overchilling = excessive runners; fall plant; tolerant of soil pathogens; susceptible to powdery mildew

Aromas - medium size; dark red color; good flavor; very high yields; long production season; fall plant; 10-21 days chilling; misshapen fruit a problem, in early season; tolerant of root and crown diseases

Diamante - large; very good flavor; light color; sensitive to rain damage; moderately vigorous plant; high productivity; long season, easy harvest; fall plant; 10-21 days chilling; susceptible to *Phytophthora*

Fern - excellent flavor; medium size; very productive; plant in spring in warm climates for July to Nov. harvest; fall plant for April to Oct. harvest.

Palomar – large excellent size and flavor

Seascape – Large size, very firm, good flavor, productive

Selva – Old variety - high yield, firm, mild flavor, Plant early September

Irvine - Old variety - winter planted day-neutral, excellent flavor

Hecker – Old variety - medium size, mild-flavored, productive



**Albion**

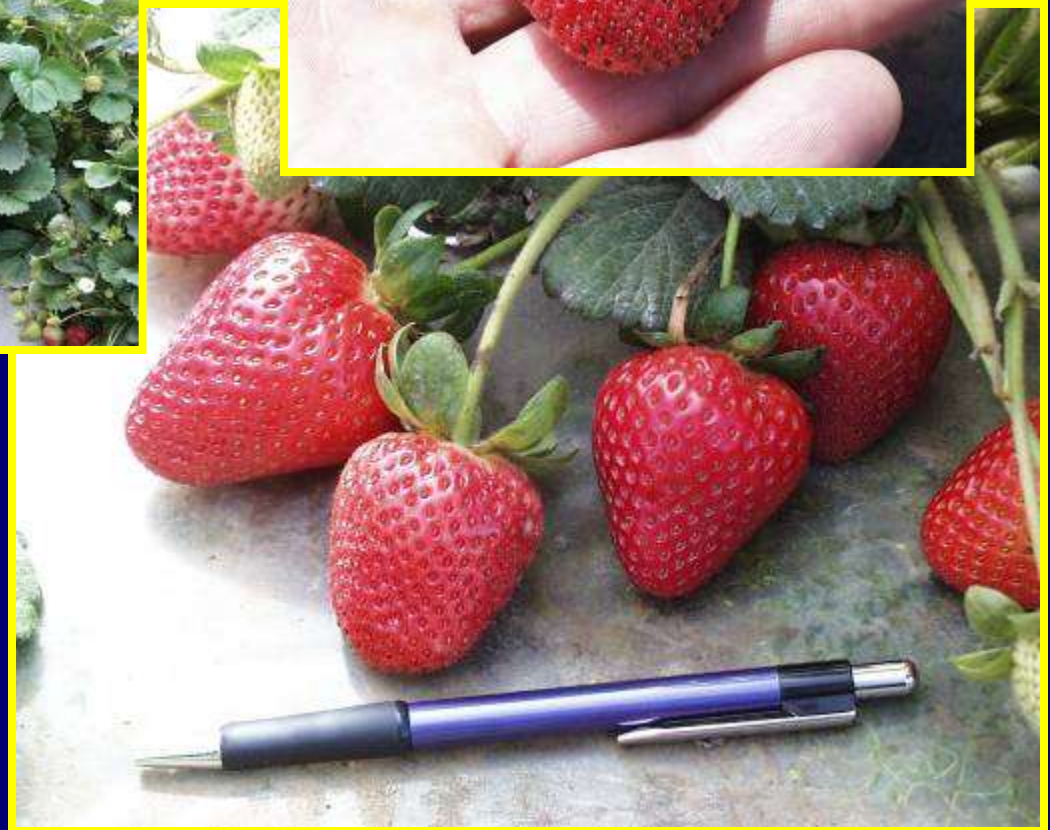
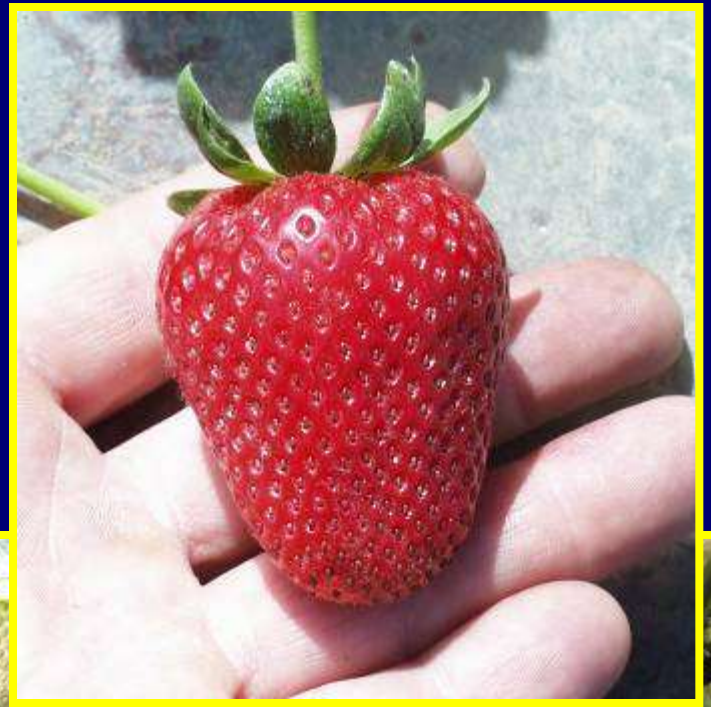




# Aromas







**Diamante**



# FERN

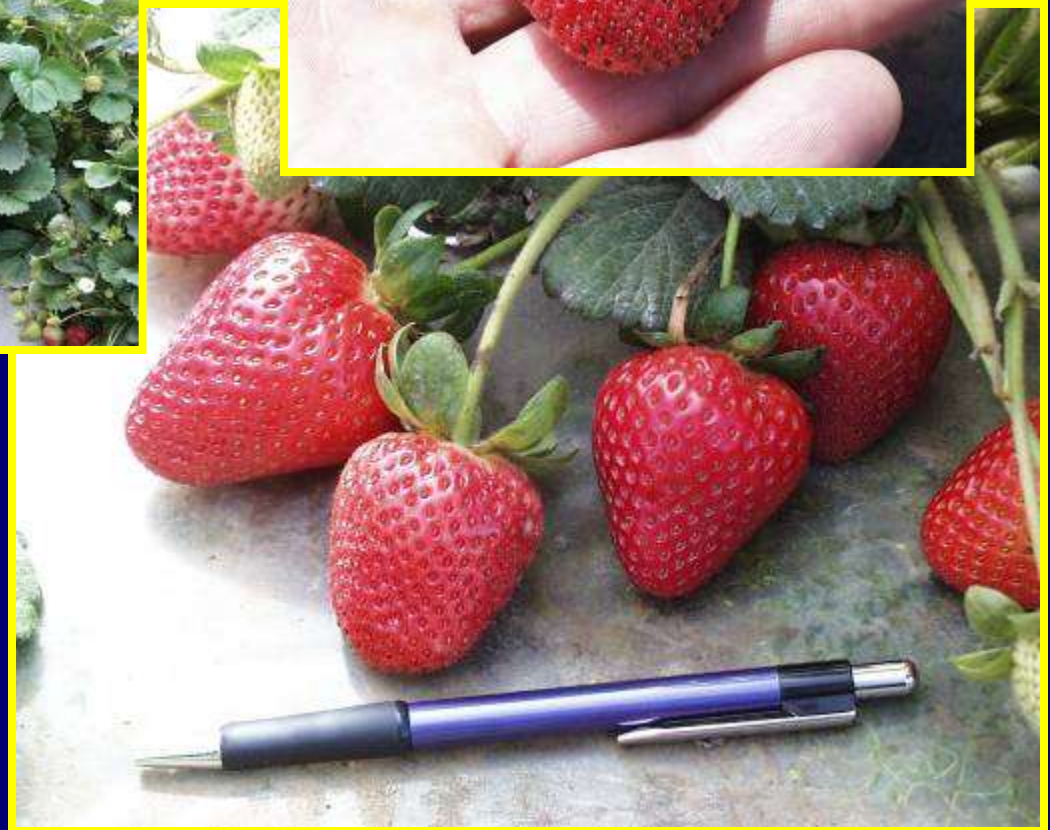




**Palomar April 5, 2007**







**Seascape**



# Fraise du Bois (Woods Strawberry)



# Bare Root Planting Dates

## Spring Bearing

- August to September
- From cold storage
- New plants = large size fruit and firm fruit

## Day Neutral/Everbearing

- Fall or Early Spring
- From cold storage
- New plants = large size and firm fruit







# Young Plants

- New plants = large size and firm fruit
- 11-13 months = large size and firm fruit
- 2-3 year old plants = small soft fruit
- Spacing – 8-12” = 50,000 to 55,000 plants/ha (15-30 cm apart)



## Green plants (leaves on)



**Perform well  
with no  
nursery chill**



# Bareroot Plants





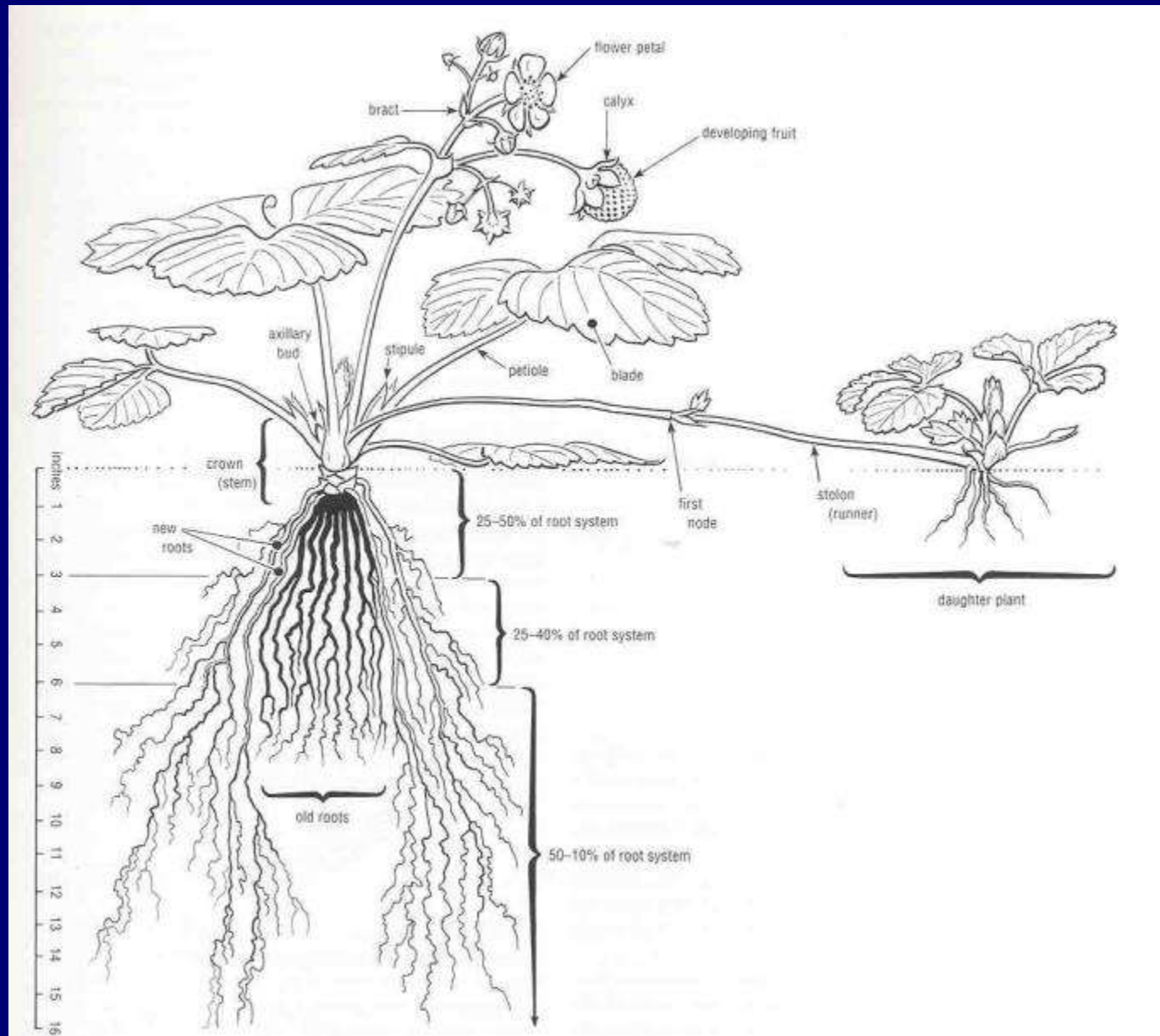
# Container Plants



- Plant in Spring
- Remove Flowers



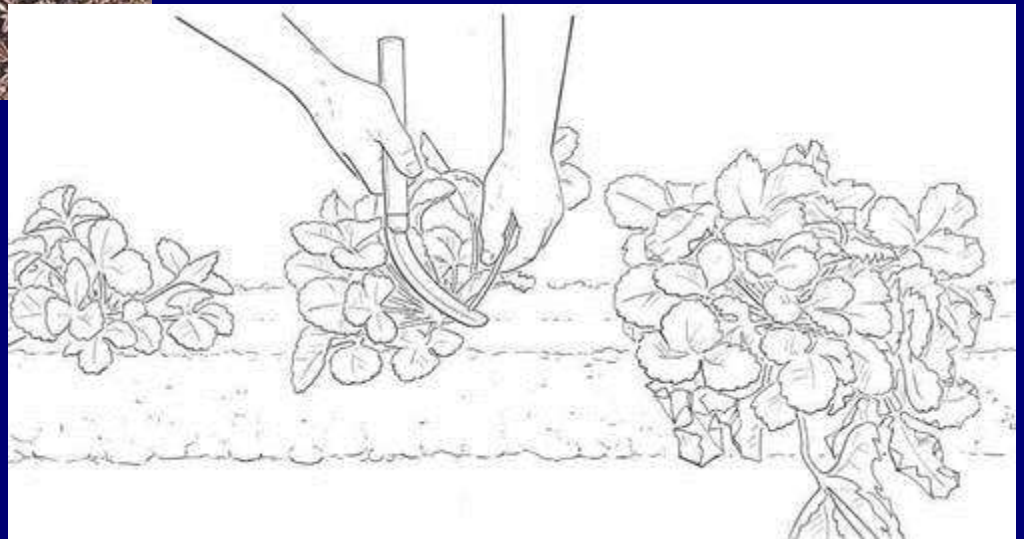
# Strawberry Development



# Remove Runners



**Runners drain  
energy and  
overcrowd plants**





# High Productivity





# Protected strawberry culture



Extended fruiting season  
Enhanced yield & quality  
Frost, rain protection  
Reduced Botrytis rot  
Reduced fungicide use  
Harvest in bad weather  
Reduced bird damage





# Strawberry Problems



**Root rot**

**Phytophthora**

**Verticillium wilt**

**Botrytis (Gray mold)**





# Berry Many Problems





# Root rot – poor drainage from no raised bed





# Overwintering Plants





# Botrytis – Gray Mold



UC Statewide IPM Project  
© 2000 Regents, University of California



# Berry Many Problems





# Verticillium Wilt





# Verticillium Wilt





Nov 4

at

79

81151-1



# Stink Bug damage





# Water soaked spot



# Strawberry Disease Resistance

Genotype	<u>P.</u> <u>cactorum</u>	<u>V.</u> <u>dahliae</u>	<u>C.</u> <u>acutatum</u>	<u>F.</u> <u>oxysporum</u>	<u>M.</u> <u>phaseolina</u>
Camarosa	3.2	3.3	2.8	2.9	3.2
Ventana	2.5	3.1	3.0	4.6	3.2
Albion	4.5	3.9	3.1	2.3	1.9
Monterey	3.9	4.2	2.9	3.5	2.8
S. Andreas	4.1	4.1	2.8	5.0	1.6
Portola	4.1	3.8	2.2	5.0	1.9
Palomar	3.3	3.9	3.1	3.4	3.2
Benicia	3.7	2.2	2.7	3.0	3.1

“1” indicates high susceptibility to disease;  
“5” indicates strong disease resistance

K. Larson



# Weed Control





# Organic Strawberries Net Returns above Total Costs 2006

PRICE \$/TRAY	YIELD (trays/acre)						
	2,500	2,750	3,000	3,250	3,500	3,750	4,000
7.00	-5,798	-5,216	-4,633	-4,051	-3,469	-2,886	-2,304
8.00	-3,298	-2,466	-1,633	-801	31	864	1,696
9.00	-798	284	1,367	2,449	3,531	4,614	5,696
10.00	1,702	3,034	4,367	5,699	7,031	8,364	9,696
11.00	4,202	5,784	7,367	8,949	10,531	12,114	13,696
12.00	6,702	8,534	10,367	12,199	14,031	15,864	17,696
13.00	9,202	11,284	13,367	15,449	17,531	19,614	21,696

Establishment & Production costs = \$29,129/acre

Ave. Yield = 3,750 flats (15 tons/acre) - - - Ave. Price = \$11/flat

**TOTAL NET = (Gross – Cost) = ~ \$12,114/acre**



# Enjoy





# Currants and Gooseberries

*Ribes species*







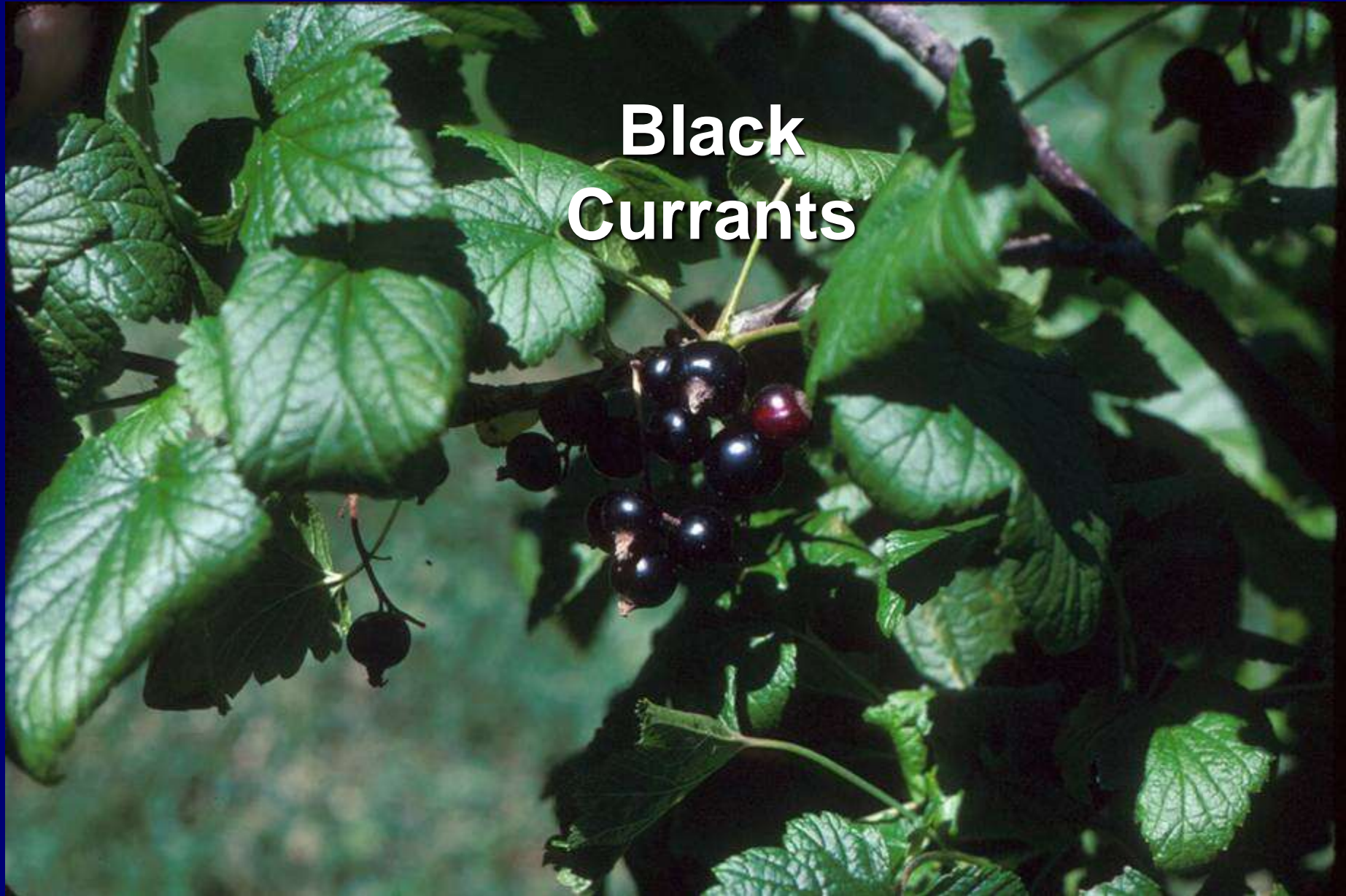




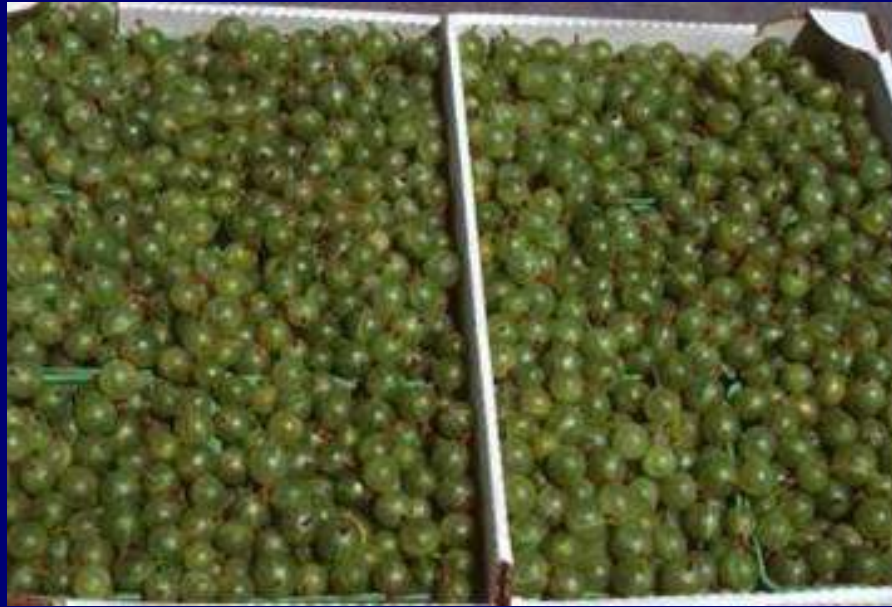
**Red  
Currants**



# Black Currants







**Gooseberries**



# Mulberry – *Morus* sp.





# Mulberry





# Mulberry



**Female Flowers**



**Male Catkins**



Mark Hurst – Sebastopol – 3.5 acres in Sheridan OR

Welcome

Products

Availability

News & Info

Food Safety

Contact

About

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Recipes

Organization

## News



BLUEBERRIES

Blueberries all year long



OREGON BLACKBERRIES

Oregon Blackberries



MEXICO

Blackberries-Red Raspberries-  
Blueberries

BLUEBERRIES

Blueberries all year long

**HBF International** has blueberries available through out the year. We begin and end the year with our South American partners in Argentina and Chile. Our Mexican fields provide blueberries in the spring when South America is finishing and the domestic market in California begins and ends in the summer in the United States.