# Organic Almond Production

by

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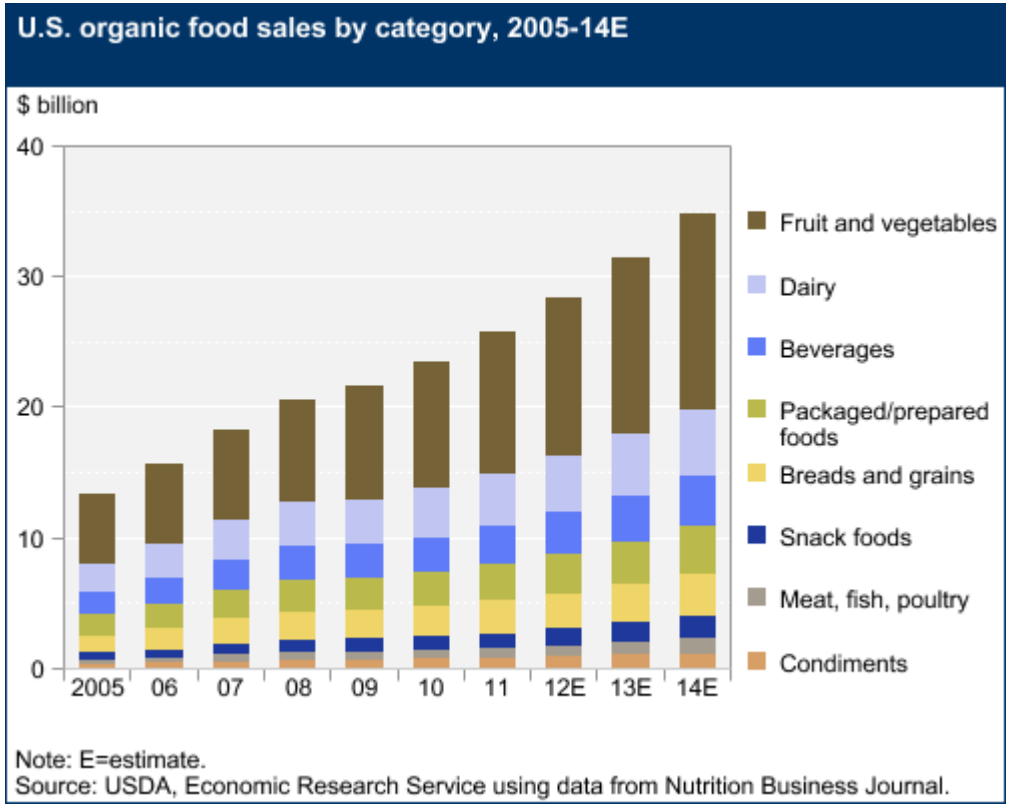
County Director and Farm Advisor

San Joaquin County

University of California
Agriculture and Natural Resources

## Organic Sales Widen in All Food Categories

USDA does not have official statistics on U.S. organic retail sales, but information is available from industry sources. U.S. sales of organic products were an estimated $28.4 billion in 2012—over 4 percent of total food sales—and will reach an estimated $35 billion in 2014, according to the *Nutrition Business Journal*.

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**Organic Market Overview**

The U.S. organic market in 2018 broke through the $50 billion mark for the first time, with sales hitting a record $52.5 billion, up 6.3 percent from the previous year, according to the 2019 Organic Industry Survey released Friday by the Organic Trade Association.


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European Union



Japanese Agricultural Standard

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AGRICULTURAL ISSUES CENTER

**2016**

SAMPLE COSTS TO PRODUCE

# ORGANIC ALMONDS

## SAN JOAQUIN VALLEY - NORTH

SOLID SET SPRINKLER IRRIGATION


| | |
|---|---|
| Brent A. Holtz | UCCE Farm Advisor / County Director, San Joaquin County |
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http://coststudies.ucdavis.edu/

# General Practices

- Start the orchard conventionally for the first 2-3 years, then transition to organic the next three.
- You will have a certified almond crop by your $6^{th}$ or $7^{th}$ leaf, just as you begin to reach your peak production years.

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# Why Start Conventionally?

- Because you will have a much more difficult time starting your almond orchard organically than conventionally.
- Weeds, nematodes, rodents, and fungal diseases can severely stress young trees and reduce their growth and canopy development!
- This early stress could slow production down by years.

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# Start Conventionally

- I have observed terrible weed control problems in orchards planted and started organically.  Trees can be permanently stunted.


- First leaf almond trees in an orchard started organically

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- Later in the season.

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Young trees can be severely damaged with propane burning; young tree bark is thin and can be burned easily

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# Start Conventional--Weed Control


Use pre-emergent and contact herbicides down the tree row the first 2-3 years for weed control

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# Start Conventional

- Fumigate if you have high concentrations of plant parasitic nematodes or if your replanting a 2nd generation almond orchard

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Replant
Disease

Fumigation
vs
control

- If you start conventional you can use baits and fumigates
- Get pests under control while you are conventional
- Pests are harder to control organically

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# Rodex 4000

- You can ignite propane and oxygen inside both squirrel and gopher burrows
- Owl boxes, traps

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# Start Conventional- Tree Nutrition

- You can supply necessary nutrients for the rapid tree growth
- It is easy to get behind nutritionally in an organic orchard.

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After starting conventional for the first 2-3 years, it is much easier to transition to organic when the canopy is established and you shade out the weeds underneath!

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# Organic Weed Control

- The propane burner has been the most used and effective method to control weeds in organic almond orchards

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# Organic Weed Control

But weed control can run up to $400 per acre in propane and tractor expenses, typically 12 applications per year

Nickels Estate-Colusa County

Mulches for weed control in organic pistachio

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Hanging drip lines in the trees

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# Pop Up Rain Bird Sprinklers?

Some organic growers have considered putting in pop up sprinklers that they can mow over?

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***Subsurface drip irrigation at harvest***

Subsurface drip irrigation on stone fruits.
You can convert after orchard establishment.

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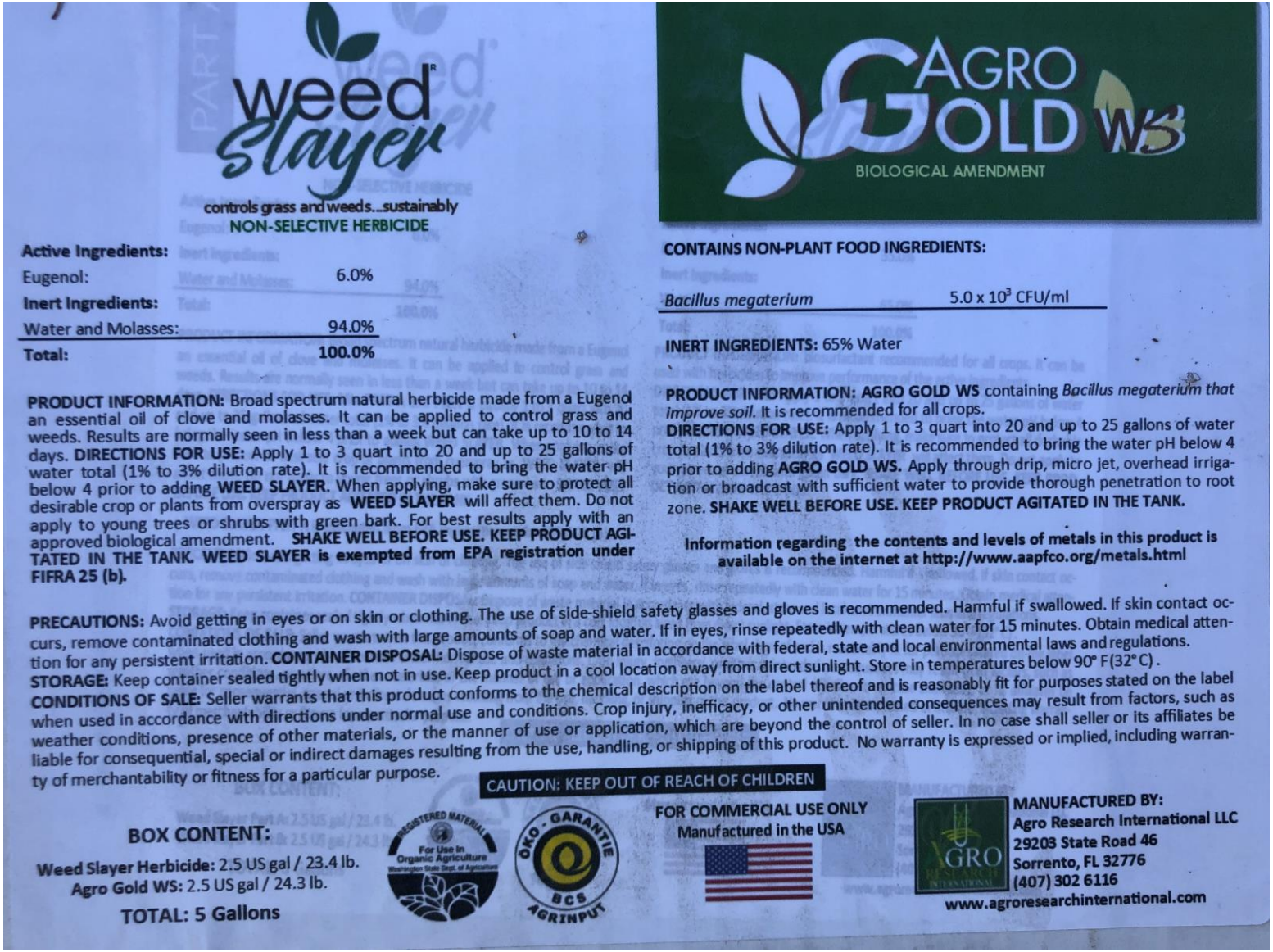

weed Slayer

controls grass and weeds...sustainably

NON-SELECTIVE HERBICIDE

| Active Ingredients: | |
|---|---|
| Eugenol: | 6.0% |
| **Inert Ingredients:** | |
| Water and Molasses: | 94.0% |
| **Total:** | **100.0%** |

**PRODUCT INFORMATION:** Broad spectrum natural herbicide made from a Eugenol an essential oil of clove and molasses. It can be applied to control grass and weeds. Results are normally seen in less than a week but can take up to 10 to 14 days. **DIRECTIONS FOR USE:** Apply 1 to 3 quart into 20 and up to 25 gallons of water total (1% to 3% dilution rate). It is recommended to bring the water pH below 4 prior to adding **WEED SLAYER.** When applying, make sure to protect all desirable crop or plants from overspray as **WEED SLAYER** will affect them. Do not apply to young trees or shrubs with green bark. For best results apply with an approved biological amendment. **SHAKE WELL BEFORE USE. KEEP PRODUCT AGITATED IN THE TANK. WEED SLAYER is exempted from EPA registration under FIFRA 25 (b).**

AGRO GOLD WS

BIOLOGICAL AMENDMENT

**CONTAINS NON-PLANT FOOD INGREDIENTS:**

| | |
|---|---|
| *Bacillus megaterium* | $5.0 \times 10^3$ CFU/ml |

**INERT INGREDIENTS:** 65% Water

**PRODUCT INFORMATION: AGRO GOLD WS** containing *Bacillus megaterium that improve soil.* It is recommended for all crops.
**DIRECTIONS FOR USE:** Apply 1 to 3 quart into 20 and up to 25 gallons of water total (1% to 3% dilution rate). It is recommended to bring the water pH below 4 prior to adding **AGRO GOLD WS.** Apply through drip, micro jet, overhead irrigation or broadcast with sufficient water to provide thorough penetration to root zone. **SHAKE WELL BEFORE USE. KEEP PRODUCT AGITATED IN THE TANK.**

**Information regarding the contents and levels of metals in this product is available on the internet at http://www.aapfco.org/metals.html**

**PRECAUTIONS:** Avoid getting in eyes or on skin or clothing. The use of side-shield safety glasses and gloves is recommended. Harmful if swallowed. If skin contact occurs, remove contaminated clothing and wash with large amounts of soap and water. If in eyes, rinse repeatedly with clean water for 15 minutes. Obtain medical attention for any persistent irritation. **CONTAINER DISPOSAL:** Dispose of waste material in accordance with federal, state and local environmental laws and regulations. **STORAGE:** Keep container sealed tightly when not in use. Keep product in a cool location away from direct sunlight. Store in temperatures below 90° F(32° C) . **CONDITIONS OF SALE:** Seller warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on the label when used in accordance with directions under normal use and conditions. Crop injury, inefficacy, or other unintended consequences may result from factors, such as weather conditions, presence of other materials, or the manner of use or application, which are beyond the control of seller. In no case shall seller or its affiliates be liable for consequential, special or indirect damages resulting from the use, handling, or shipping of this product. No warranty is expressed or implied, including warranty of merchantability or fitness for a particular purpose.

**CAUTION: KEEP OUT OF REACH OF CHILDREN**

**BOX CONTENT:**

**Weed Slayer Herbicide:** 2.5 US gal / 23.4 lb.
**Agro Gold WS:** 2.5 US gal / 24.3 lb.

**TOTAL: 5 Gallons**

REGISTERED MATERIAL For Use In Organic Agriculture Washington State Dept. of Agriculture

OKO-GARANTIE BCS AGRINPUT

**FOR COMMERCIAL USE ONLY**
Manufactured in the USA

**MANUFACTURED BY:**
**Agro Research International LLC**
**29203 State Road 46**
**Sorrento, FL 32776**
**(407) 302 6116**
**www.agroresearchinternational.com**

There are organic herbicides, but they are expensive, and results have been mixed.

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Frank Olagaray in Walnut Grove, developed this nice berm tiller for weed control, and started transitioning his almonds to organic in the second leaf. He will have first organic crop on his 5th leaf.

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Irrigation tubing was attached to wire and run through tree canopy. The micro-sprinkler hangs down from the tubing to allow berm cultivation.

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# Nickel's Estate, Organic Trial established in 2008, by Franz Niederholzer

**Standard** **Organic**

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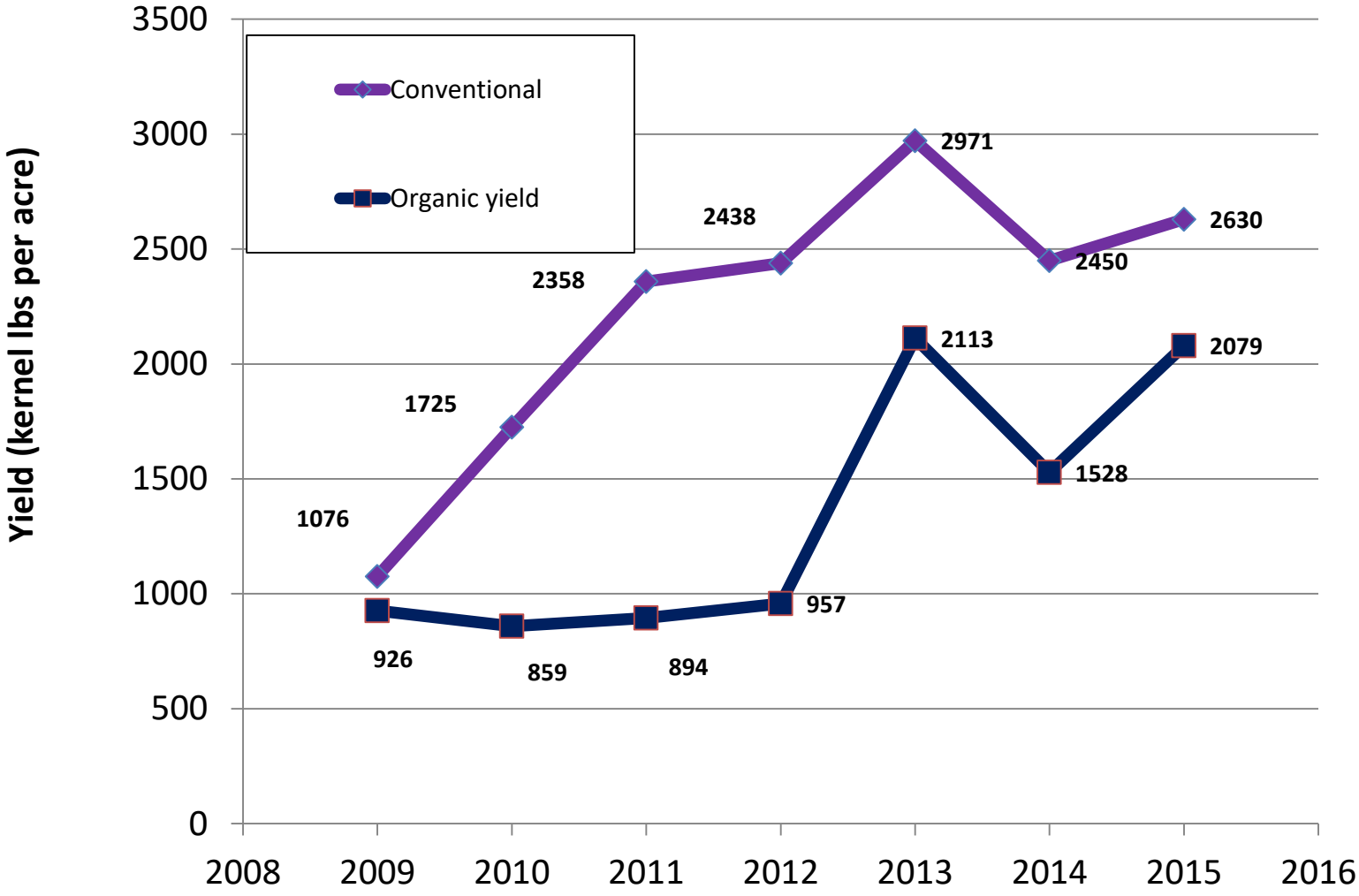
# NP yields for conventional and organic treatments 2009-2015.

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## Good production (lbs/acre) under organic management has been achieved after rust controlled in 7th leaf.

| Leaf | Year | Conventional | Organic | Org:Conv | %Leaf N (org) |
|---|---|---|---|---|---|
| 7th leaf | 2012 | 2438 | 957 | 0.39 | 2.39 |
| 8th leaf | 2013 | 2971 | 2113 | 0.71 | 2.41 |
| 9th leaf | 2014 | 2450 | 1528 | 0.62 | 1.99 |
| 10th leaf | 2015 | 2630 | 2079 | 0.79 | 2.05 |
| 11th leaf | 2016 | 2198 | 1542 | 0.69 | 2.11 |
| 12th leaf | 2017 | 2217 | 1406 | 0.63 | 2.16 |
| 13th leaf | 2018 | 2542 | 2090 | 0.82 | 1.96 |

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**2016**

SAMPLE COSTS TO PRODUCE

# ORGANIC ALMONDS

Annual Yield Estimates

| Year | Organic Kernel lbs. | Conventional Kernel lbs. |
|---|---|---|
| 3 | 300 | 400 |
| 4 | 600 | 800 |
| 5 | 1,300 | 1,600 |
| 6+ | 1,800 | 2,200 |

Typically we project a 20% yield reduction

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# Cover Crops and Nitrogen

Vigorous cover crops can have many benefits, but they often produce
seed and use nitrogen at a critical time of kernel development!

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# Native vegetation

Most organic growers do not plant a cover crop and they mow row centers to reduce frost potential.

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- Organic growers may apply up to 10 tons of compost per acre per year in order to keep their trees from getting behind in nitrogen. In a compost that is 1.0 % N, then it will take 10 tons per acre to get the recommended 200 units of N we recommend for a mature almond orchard.
- Typically done in two applications.

# Tree Nutrition- Potassium

- If you are applying up to 10 tons of compost per year in order to get your 200 units of N, you are also putting on potassium.  Typically composts have more potassium than nitrogen.
- You can also get a lot of calcium, phosphorus, and organic matter from compost.

NEW ERA FARM SERVICE

www.newerafarmservice.com

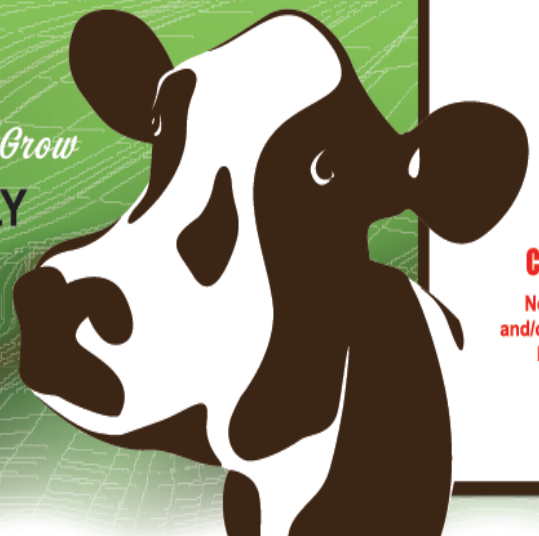
# COMPOST

## COMPOSTED DAIRY MANURE

**1.25 - 1.50 - 2.50**

FOR USE WITH A STANDARD FERTILIZER PROGRAM

REGISTERED cdfa ORGANIC INPUT MATERIAL



*Helping Farmers Grow*

NATURALLY

*since 1974*


Manufactured by:
New Era Farm Service, Inc.
2904 E Oakdale Ave
Tulare, CA 93274
559.686.3833


## GUARANTEED ANALYSIS

| | |
|---|---|
| **Total Nitrogen (N)** | **1.25%** |
| 0.25% Water Soluble Nitrogen | |
| 1.00% Water Insoluble Nitrogen | |
| **Available Phosphoric Acid (P205)** | **1.50%** |
| **Soluble Potash (K2O)** | **2.50%** |

**Derived from Composted Dairy Manure**

## SUGGESTED RATES OF APPLICATION

### Commercial Crop Production

**Use 3-10 tons per acre (43,560 square feet)**

### Professional Turf Application

**Use 40-100 pounds per 1000 square feet**

### Trees, Shrubs & Ornamentals

One cubic foot of NEW ERA COMPOST will plant the following:

40 - One gallon size plants using 1 pound per plant
8 - Five gallon size plants using 5 pounds per plant
4 - Fifteen gallon size plants using 10 pounds per plant

*Approximate ratio is one part* NEW ERA COMPOST *per six parts soil.*

## CONTENTS

**Lot Number:** _____

☐ **BULK** _____

☐ **CU. FT.** _____

## CAUTION: KEEP OUT OF REACH OF CHILDREN

**No immediate hazard if swallowed. If contact with eyes, skin and/or clothing occurs, flush with water and avoid further contact. Non-toxic when spilled or leaked. Biodegradable Material**

Seller makes no warranty expressed or implied, concerning the use of this product other than indicated on this label. Buyer assumes all risks of use and handling.

# New Era Compost-Typical Analysis

| | | 10 ton application |
|---|---|---|
| Nitrogen | 1.25% | 250 lbs |
| Phosphorus | 1.50% | 300 lbs |
| Potassium | 2.50% | 500 lbs |
| Calcium | 2.60% | 520 lbs |
| Sulfur | 0.50% | 100 lbs |
| Magnesium | 1.16% | 232 lbs |
| Sodium | 0.40% | 80 lbs |
| Organic matter | 30.2% | 6,040 lbs |

(C:N ratio 14:1),

cost $30 ton / $300 per acre

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# New Era Composts-with analysis

- Dairy manure blend goes through a controlled thermophilic, bio-oxidative process, lasting from 90 to 120 days.
- The compost has reached a high temperature of 158° F and averaged a thermophilic temperature of 140 ° F from 90-120 days
- The compost tested negative for *Salmonella*, *E. coli*, and *Staphylococcus*
- With food safety concerns it is recommended that almond growers use tested compost rather than fresh animal manures

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# Organic liquid fertilizers $$$ generally 10 X price of UN32…




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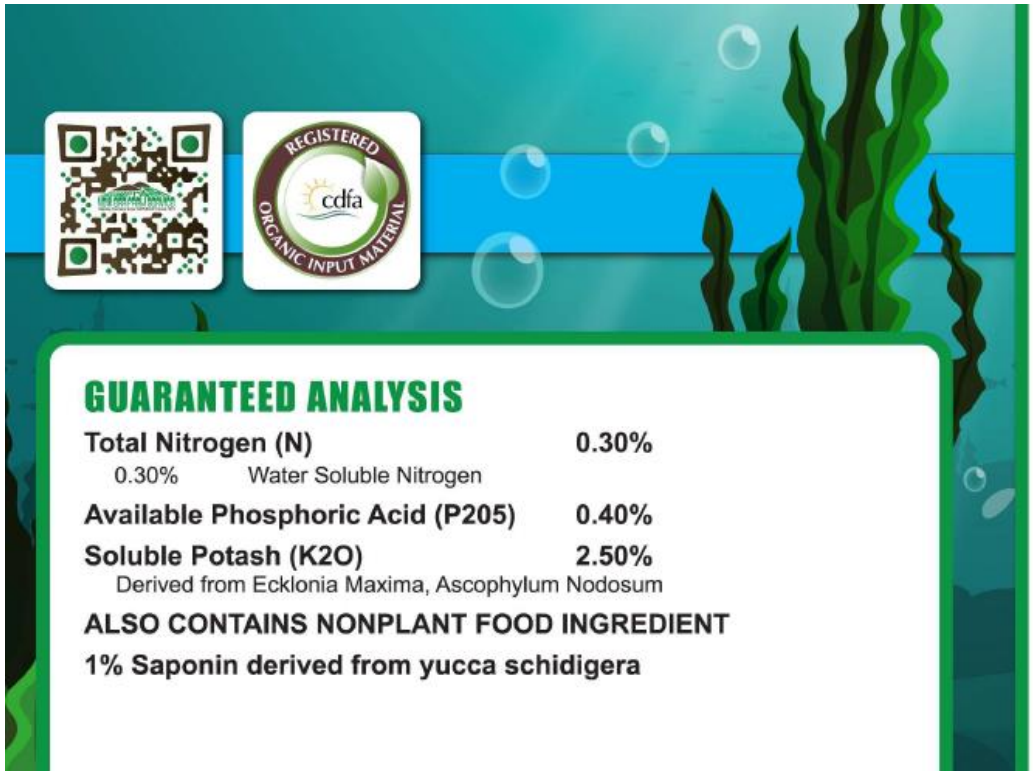



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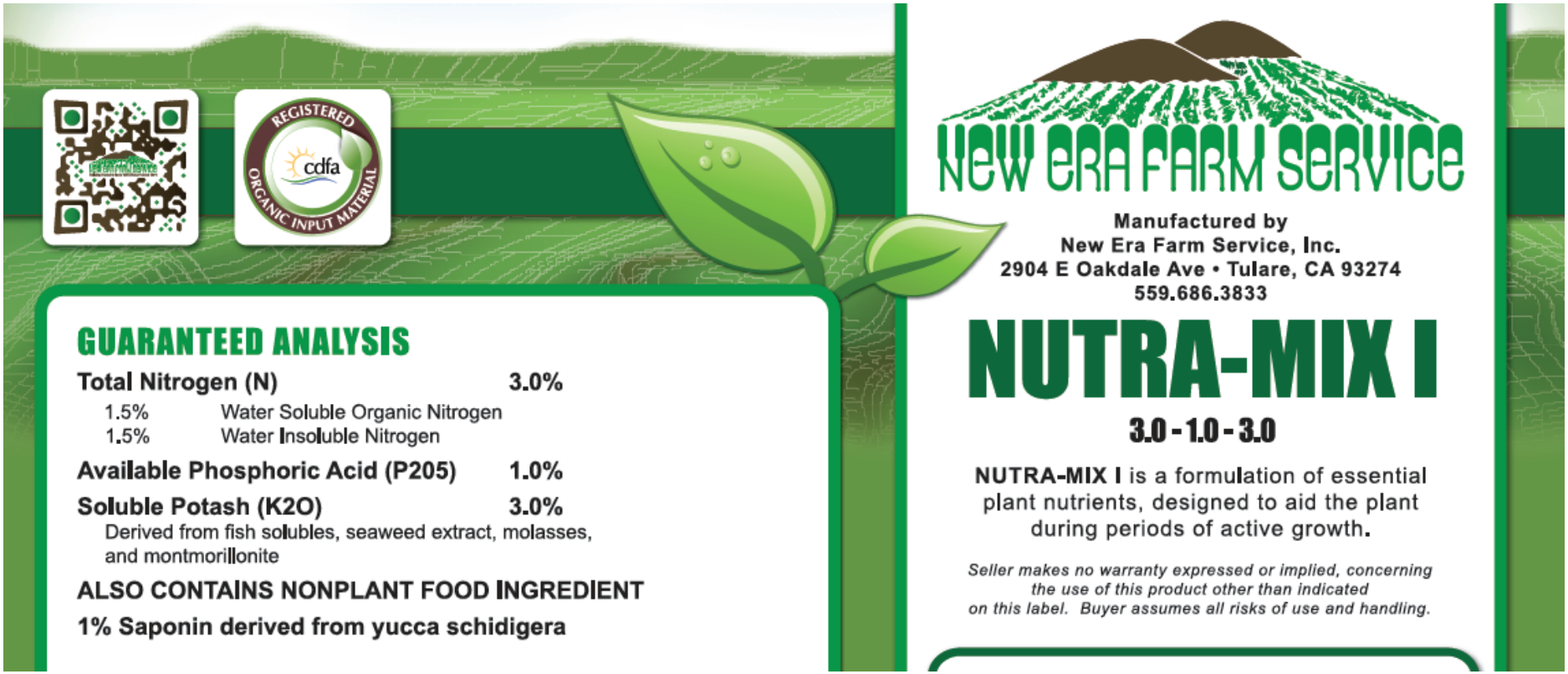


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# Tree Nutrition-
# Zinc and Boron

- Organic growers can use Zinc Sulfate 36% at label rates (10-15 lbs/acre) in the Fall if leaf analysis shows the orchard is low in zinc.
- Solubor can also be used by organic growers for supplying Boron.
- Always check with your certifier to make sure whatever you want to apply is organically approved—the rules keep changing.

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# Almond Varieties for Organic Production

- Some varieties are easier to farm organically than others.
- Many of us thought that the hard shell varieties would be easier to grow organically than soft shells because we wouldn't have to worry about insect and ant damage.
- We were wrong!

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# Hard Shells are susceptible to Brown Rot

- Varieties with tight flower clusters are more susceptible to brown rot (*Monilinia)* and jacket rot (*Botrytis)*

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# Nonpareil for Organic Production

- Nonpareil is susceptible to NOW and ant damage
- But Nonpareil is very resistant to brown rot when compared to other varieties
- Organic Nonpareil growers have been able to avoid brown rot and control NOW by using extremely rigid sanitation practices

# Hard Shells for Organic Production

- The Hard shells are very resistant to NOW and ant damage
- But the hard shells are very susceptible to Brown Rot, Botrytis, and Scab diseases
- Many organic growers have pulled their hard shells out of organic production because of heavy loses to brown rot.

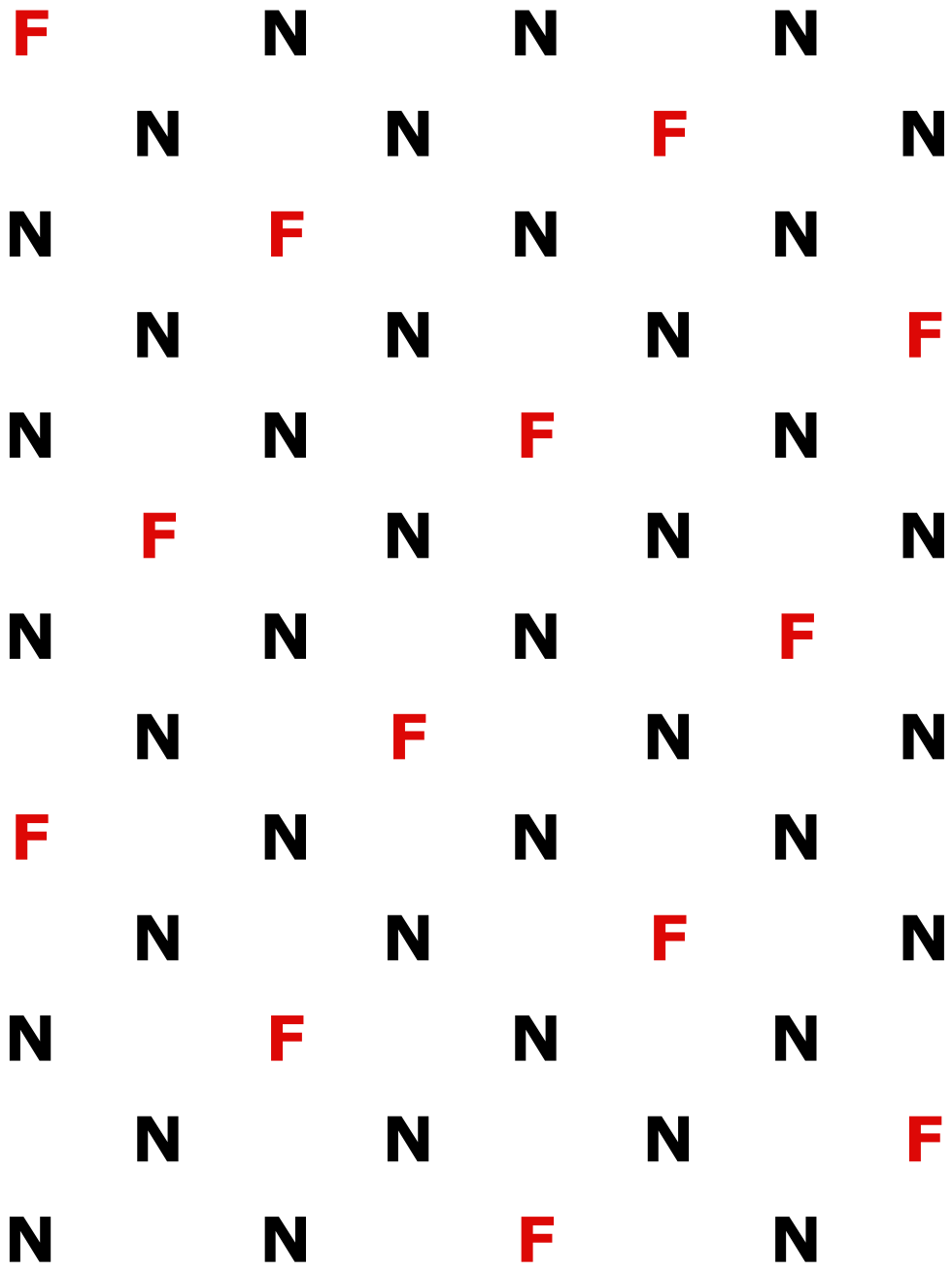
Nickel's Estate

Organic growers have tried to increase the percentage of NP

75 % Nonpareil

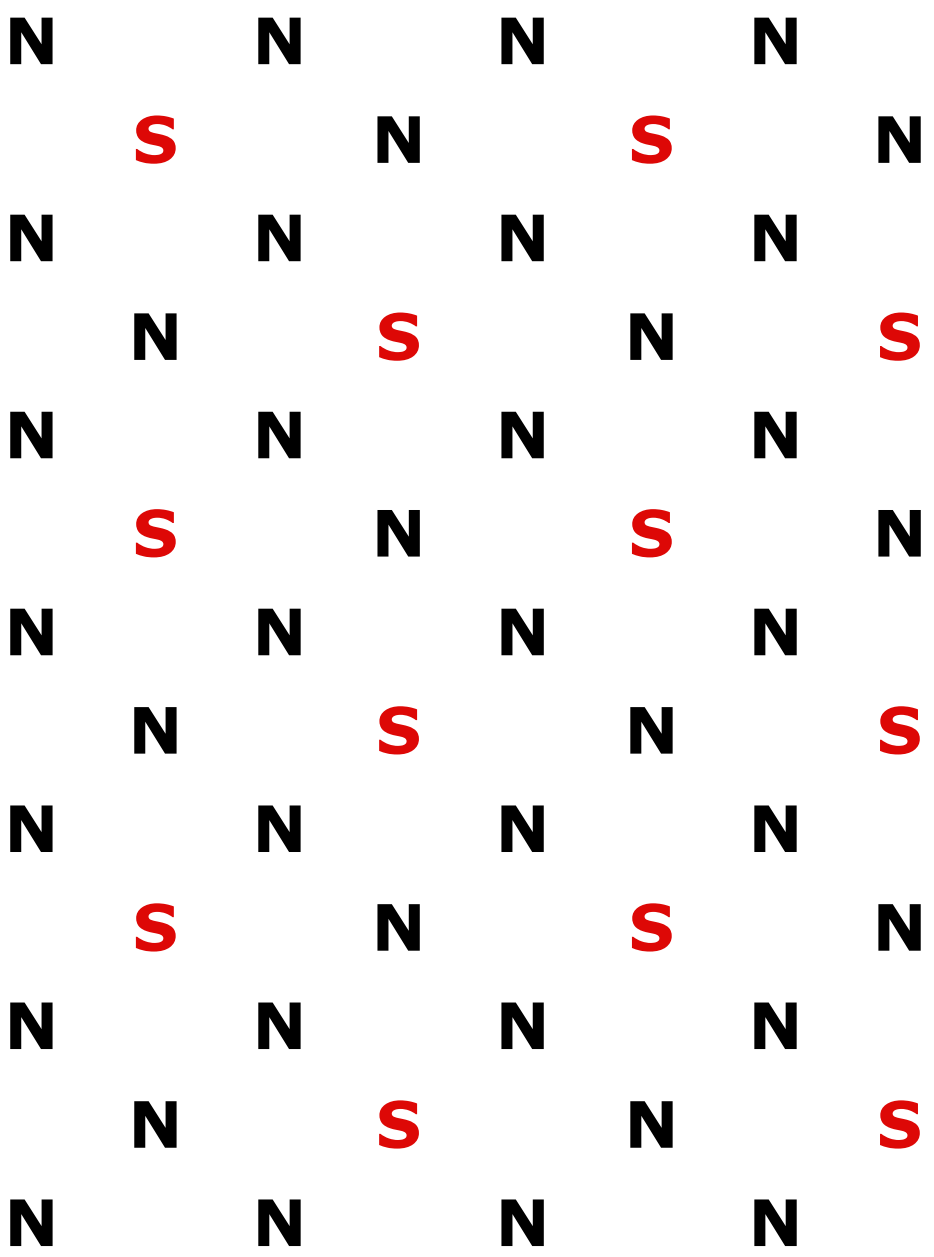
25 % Fritz

75% premium, resistance



Ray Pool,
Madera

75 % Nonpareil
25 % Sonora
100% premium,
with resistance



# Disease Management in Organic Almond Production

When almond trees are blooming their flowers are susceptible to a number of plant pathogenic fungi capable of causing disease.

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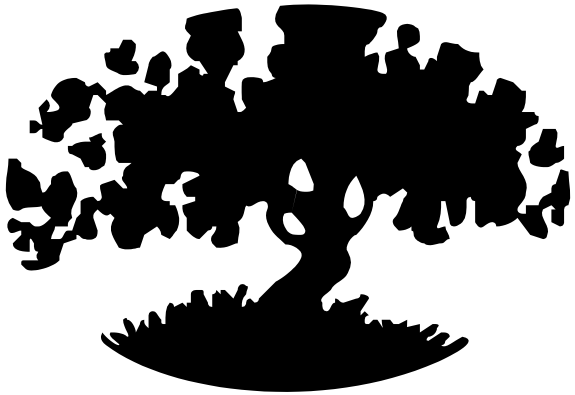
# EFFICACY AND TIMING OF FUNGICIDES, BACTERICIDES, AND BIOLOGICALS
## *for*
# DECIDUOUS TREE FRUIT, NUT, STRAWBERRY, AND VINE CROPS
## 2009

**(Updated June, 2009)**

**www.ipm.ucdavis.edu**



| | |
|---|---|
| ***ALMOND*** | ***PEACH/NECTARINE*** |
| ***APPLE/PEAR*** | ***PISTACHIO*** |
| ***APRICOT*** | ***PLUM*** |
| ***CHERRY*** | ***PRUNE*** |
| ***GRAPE*** | ***STRAWBERRY*** |
| ***KIWIFRUIT*** | ***WALNUT*** |


**Jim Adaskaveg, Professor**
*University of California, Riverside*

**Doug Gubler, Extension Plant Pathologist**
*University of California Davis*

**Themis Michailides, Plant Pathologist**
*University of California, Davis/Kearney Agricultural Center*

**Brent Holtz, Farm Advisor**
*University of California Cooperative Extension, Madera County*

## ALMOND—TREATMENT TIMING

**Note: Not all indicated timings may be necessary for disease control.**

| | | Bloom | | | Spring[1] | | Summer | |
|---|---|---|---|---|---|---|---|---|
| Disease | Dormant | Pink bud | Full bloom | Petal fall | 2 weeks | 5 weeks | May | June |
| Alternaria | ---- | ---- | ---- | ---- | ---- | +++ | +++ | +++ |
| Anthracnose[2] | ---- | ++ | +++ | +++ | +++ | +++ | +++ | ++ |
| Brown rot | ---- | ++ | +++ | + | ---- | ---- | ---- | ---- |
| Green fruit rot | ---- | ---- | +++ | ---- | ---- | ---- | ---- | ---- |
| Leaf blight | ---- | ---- | +++ | ++ | + | ---- | ---- | ---- |
| Scab[3] | ++ | --- | --- | ++ | +++ | +++ | + | --- |
| Shot hole[4] | +[5] | + | ++ | +++ | +++ | ++ | ---- | ---- |
| Rust | ---- | ---- | ---- | ---- | ---- | +++ | +++ | +[6] |

**Rating:** +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

[1] Two and five weeks after petal fall are general timings to represent early postbloom and the latest time that most fungicides can be applied. The exact timing is not critical but depends on the occurrence of rainfall.

[2] If anthracnose was damaging in previous years and temperatures are moderate (63°F or higher) during bloom, make the first application at pink bud. Otherwise treatment can begin at or shortly after petal fall. In all cases, application should be repeated at 7- to 10-day intervals when rains occur during periods of moderate temperatures. Treatment should, if possible, precede any late spring and early summer rains. Rotate fungicides, using different fungicide classes, as a resistance management strategy.

*Efficacy: Tree Crops, continued*

| Fungicide | Brown rot | Jacket rot (Botrytis) | Shot hole | Powdery mildew | Rust | Scab | | Anthracnose | Alternaria |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Almond | Apple/pear | | |
| **BIOLOGICALS, NATURAL COMPOUNDS, SARs** | | | | | | | | | |
| Copper | + | + | ++ | ---- | ---- | ++[13] | ---- | ---- | +/- |
| Cinnacure | ---- | ---- | ---- | ++ | ---- | ---- | ---- | ---- | ---- |
| JMS Stylet Oil | +/- | ---- | +/- | ++ | ---- | ---- | ---- | ---- | ---- |
| Kaligreen | ---- | ---- | ---- | ++ | ---- | ---- | ---- | ---- | ---- |
| Messenger | ---- | ---- | ---- | ++ | ---- | ---- | ---- | ---- | ---- |
| Oxidate | ---- | ---- | +/- | ND | ND | ---- | ---- | ---- | ---- |
| Perasan | ---- | ---- | +/- | ND | ND | ---- | ---- | ---- | ---- |
| Prev-am | ND | ND | ND | ++ | ND | ---- | ---- | ---- | ---- |
| Quiponin[4,6] | ND | ND | ND | ++ | ND | ND | ND | ND | ND |
| Regalia | + | - | ND | ND | ND | ND | ND | ND | ND |
| Serenade | +/- | + | +/- | ++ | ND | ---- | ND | ND | ND |
| Sonata | +/- | + | +/- | ++ | ND | ---- | ND | ND | ND |
| Sulfur | + | + | +/- | +++ | +++ | ++ | ++ | + | ---- |
| Trilogy | +/- | ---- | + | ++ | +/- | ---- | ---- | ---- | ---- |
| Sporan | + | ---- | +/- | ++ | +/- | ---- | ---- | ---- | ---- |
| Saf-T-Side | ++ | ---- | +/- | ++ | ---- | ---- | ---- | ---- | ---- |
| Valero | +/- | ---- | ---- | ND | ND | ---- | ---- | ---- | ---- |

**Rating**: ++++ = excellent; +++ = very good; ++ = good; + = fair; +/- = minimal or often ineffective; - = ineffective; NR = not registered; ND = no data

***** Not registered in California

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## Brown Rot Blossom Blight
## Pathogen: *Monilinia laxa;* rarely *Monilinia fructicola*

- Flowers may become infected from pink bud to petal fall
- Tight clusters are susceptible

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**Evaluation of fungicides for control of brown rot, 2006**

| Treatment with Per acre Rate (Date of application)[zy] | Mean Strikes/Tree[x] |
|---|---|
| Abound 2.08SC, 12.8 fl oz + BreakThru 0.125% (a,b,c) | 0.8 a |
| Propimax EC 4 fl oz + BreakThru 0.125% (a,b,c) | 1.2 a |
| V10116 50WDG + BreakThru 0.125%(a,b,c) | 1.4 a |
| USF 2010 50WG 6 oz + BreakThru 0.125% (a,b,c) | 1.6 ab |
| Orbit EC 5 fl oz + Abound 2.08SC 10 fl oz + BreakThru 0.125% (a,b,c) | 1.8 ab |
| Orbit EC 4 fl oz + Abound 2.08 SC 8 fl oz + BreakThru 0.125% (a,b,c) | 2.2 ab |
| V10135 50DF + V10116 50WDG (a,b); V10135 50DF + V10116 50WDG (c) | 2.2 ab |
| Enable 2F 6 fl oz + BreakThru 0.125% (a,b,c) | 3.2 ab |
| Trilogy 5.46L 1% + Rovral 4F 16.0 fl oz (a,b); Echo Ultimate 82.5WP 3.6 lb (c) | 4.2 ab |
| Vangard 75WG 5 oz + BreakThru 0.125% (a,b,c) | 4.2 ab |
| Gem 500SC 3 fl oz + BreakThru 0.125% (a,b,c) | 4.6 ab |
| Laredo 1.67EW + BreakThru 0.125% (a,b,c | 5.2 abc |
| V10135 50DF 8 oz + BreakThru 0.125% (a,b); V10135 50DF 6 oz + V10116 50WDG 1.72 © | 5.6 abc |
| Topsin 70WDG 1 lb + Ziram 76DF 6 lb + BreakThru 0.125% (a,b); Ziram 76DF 8 lb + BreakThru 0.125% (c) | 7.8 abcd |
| Echo Ultimate 82.5WP 3.6 lb (a,b,c) | 8.6 abcde |
| Saf-T-Side 1% (a,b,c) | 8.8 abcde |
| Topsin 70WDG 1 lb + Ziram 76DF 6 lb + BreakThru 0.125% (a,b); Ziram 76DF 6 lb + Microthiol Disperss 80 MWS 6 lb (c) | 11.0 abcdef |
| Trilogy 5.46L 1% + Rovral 4F 1 pt (a,b,c) | 11.0 abcdef |
| Topsin 70WP 1 lb + Ziram 76DF 6 lb + BreakThru 0.125% (a,b); Ziram 76DF 6 lb + Microthiol Disperss 80 MWS 6 lb | 12.8 abcdefg |
| Captan 50WP 4 lb + Surfix 0.06% (a,b,c) | 13.2 abcdefg |
| Cuprofix Ultra 40D 4 lb + Surfix 0.125% (a,b); Cuprofix Ultra 40D 1 lb + Surfix 0.125% (c) | 13.2 abcdefg |
| Echo 6L 4 pt (a,b,c) | 13.2 abcdefg |
| Sporan EC 3 pt + Captan 50WP 4 lb + BreakThru 0.125% (a,b,c) | 13.6 abcdefg |
| Sporan EC 3 pt + BreakThru 0.125% (a,b,c) | 15.8 abcdefg |
| Sporan EC 3 qt + BreakThru 0.125% (a,b,c) | 16.2 abcdefg |
| Echo 6L 2 qt + Sonata ASO 96 fl oz (a,b,c) | 16.4 abcdefg |
| Captan 50WP 4 lb +Sonata ASO 96 fl oz + Surfix 0.06% (a,b,c) | 20.4 bcdefgh |
| Serenade Max 14.6WP 1 lb + Surfix 0.06% (a,b,c) | 24.2 cdefgh |
| Microthiol Disperss 80 MWS 6 lb + Surfix 0.125% (a,b,c) | 26.0 defgh |
| Stylet Oil 1% (a,b,c) | 27.4 efgh |
| Liquid Lime Sulfur 10.6L 2 gal (a,b,c) | 29.8 fgh |
| Trilogy 5.46L 1% (a,b,c) | 31.4 gh |
| Trilogy 5.46L 1% + Sonata ASO 96 fl oz (a,b,c) | 31.4 gh |
| Sonata ASO 96 fl oz + Surfix 0.06 % (a,b,c) | 38.0 hi |
| Oxidate 1% | 57.0 ij |
| Control | 67.1 j |
| Fisher's least significant difference (LSD, $P \leq 0.05$) test[w] | 19.1834 |

2016 Brown Rot Per 100 Flowers
Butte Variety

| Treatment | Rates per acre | Brown Rot[a] | |
|---|---|---|---|
| 12 | A19649B Experimental[1,2,3], 5.13 fl oz | 1.50 | a |
| 14 | A20560C Experimental[1,2,3], 6.84 fl oz | 2.50 | a |
| 04 | Aproach + Fontelis 1.67 SC[1,2,3], 6 fl oz + 14 fl oz | 3.25 | a |
| 16 | R-106506 SC Experimental[1,2,3], 5.08 fl oz | 4.00 | a |
| 13 | A20259E Experimental[1,2,3], 13.7 fl oz | 4.00 | a |
| 15 | R-106506 SC Experimental[1,2,3], 3.38 fl oz | 4.50 | a |
| 11 | Quadris Top[1], 14 fl oz, Bravo[2] 4 pt (no DA), Inspire EC[3], 7 fl oz | 4.50 | a |
| 09 | RON94-112 Experimental[1,2,3], 43.4 fl oz (no Dyne-Amic) | 4.75 | a |
| 05 | Aproach + Fontelis 1.67 SC[1,2,3], 8 fl oz + 16 fl oz | 5.25 | ab |
| 20 | Fontelis[1,3], 20 fl oz, Regalia[2], 2 quarts | 5.50 | ab |
| 08 | RON94-112 Experimental[1,2,3], 43.4 fl oz | 5.50 | ab |
| 10 | RON94-112[1], 28.9 fl oz, RON94-374 Experimental[2,3], 28.9 fl oz | 6.50 | ab |
| 07 | RON94-112 Experimental[1,2,3], 28.9 fl oz | 6.75 | ab |
| 06 | Quadris Top[1,2,3], 12 fl oz | 9.00 | abc |
| 03 | Aproach 2.08 SC[1,2,3], 12 fl oz | 9.00 | abc |
| 17 | Timorex Gold[1,2,3], 1.5 L/Ha | 10.50 | abcd |
| 02 | Aproach 2.08 SC[1,2,3], 8 fl oz | 15.75 | bcd |
| 01 | Aproach 2.08 SC[1,2,3], 6 fl oz | 19.75 | cde |
| 19 | Microthiol Disperse[1,2,3], 20 lbs | 21.00 | de |
| 18 | Timorex Gold[1,2,3], 2.0 L/Ha | 29.75 | e |
| 21 | Untreated Control | 48.25 | f |
| 22 | Untreated Control | 49.50 | f |

[a]Brown Rot = Brown Rot was rated on the Butte variety on March 21st, 10 limbs per tree and 10 blossoms per limb were rated for brown rot infections, determined per 100 blossoms. Means followed by the same letter are not significantly different.
[1]First trial application was performed at 100% full bloom Butte variety (FB) on February 25th.
[2]Second trial application was performed 3 weeks after petal fall (3WPF) on March 16th.
[3]Third trial application was performed 5 weeks after petal fall (5WPF) on March 30th.

# Almond Scab

## *Cladosporium carpophilum*

Gray-black, oil-like soft looking spots form on leaves, fruit, and twigs.

# Timing of Fungicide Treatments for Scab Control

**Note: Not all indicated timings may be necessary for disease control.**

| | | Bloom | | | Spring[1] | | Summer | |
|---|---|---|---|---|---|---|---|---|
| **Disease** | **Dormant** | **Pink bud** | **Full bloom** | **Petal fall** | **2 weeks** | **5 weeks** | **May** | **June** |
| Scab[3] | ++ | --- | --- | ++ | +++ | +++ | + | --- |

**Rating:** +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

[3] Early treatments (during bloom) have minimal effect on scab; the 5-week treatment usually is most effective. Treatments after 5 weeks are useful in northern areas where late spring and early summer rains occur. Dormant treatment with liquid lime sulfur improves efficacy of spring control programs.

- Dormant applications of copper and oil have shown efficacy against scab.
- Micronized sulfur has done a great job of controlling scab at 2 and 5 weeks after petal fall.

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Carmel Variety

| Treatment | Rates per acre | Incidence[a] | |
|---|---|---|---|
| 6 | Bravo (Chlorothalonil)[1] 4 pt, Quadris Top[2] 14 fl oz, Inspire Super[3] 20 fl oz | 0.0 | a |
| 11 | Rovral +oil +Topsin[1], 8 fl oz+1%v/v+10 fl oz, Quadris[2],14 fl oz, Captan[3], 5lbs | 0.2 | a |
| 18 | Microthiol Disperse[1,2,3] 20 lbs | 0.4 | a |
| 3 | Fontelis + Tebucon 45DF[1,2,3], 20 fl oz + 8 oz | 0.6 | a |
| 17 | Merivon SC[1,2,3] 6.5 fl oz | 0.6 | a |
| 7 | Quadris Top[1] 14 fl oz, Bravo (Chlorothalonil)[2] 4 pt, Inspire Super[3] 20 fl oz | 0.8 | a |
| 12 | Rovral +oil+Topsin[1], 11.4floz+1%v/v+14 floz, Quadris[2],14 floz,Captan[3], 5lbs | 0.8 | a |
| 13 | Luna Sensation SC[1,2,3], 6 fl oz | 1.6 | a |
| 14 | Luna Experience[1,2,3], 6 fl oz | 1.8 | a |
| 15 | Luna Experience[1,3], 6 fl oz, Gem+Serenade Optimum[2], 3.0 fl oz + 8 oz | 2.8 | ab |
| 2 | Fotelis + Bumper 3.6EC[1,2,3], 20 fl oz + 8 fl oz | 2.8 | ab |
| 10 | Rovral + oil + Topsin[1,2], 11.4 fl oz+1%v/v + 14 fl oz, Captan[3], 5 lbs | 6.8 | b |
| 9 | Rovral + oil + Topsin[1,2], 8 fl oz+1%v/v + 10 fl oz, Captan[3], 5 lbs | 7.0 | b |
| 16 | Pristine[1,2,3], 14.5 oz | 16.6 | c |
| 5 | Fotelis + Gem 4.05SC[1,2,3], 20 fl oz + 2.9 fl oz | 21.0 | cd |
| 4 | Fotelis + Abound 2.0 8F[1,2,3], 20 fl oz + 12 fl oz | 24.2 | d |
| 8 | Rovral + oil[1,2], 16 fl oz+1%v/v, Captan 80 WG[3], 5 lbs | 24.6 | de |
| 1 | Fontelis 1.67 SC[1,2,3], 20 fl oz | 29.4 | e |
| 19 | Untreated Control | 35.0 | f |
| 20 | Untreated Control | 35.4 | f |

[a]Incidence = number of nuts that have scab lesions on 45 nuts randomly sampled per tree. Three people rated each tree (Cheryl, Scotty, and Stephen). Data was analyzed by ANOVA with means separated by Fisher's Protected LSD ($\alpha = 0.05$) test. Means followed by the same letter are not significantly different. The trial was rated on August 5th and 6th, 2014. All treatments significantly reduced the incidence of almond scab when compared to our two untreated controls.

The following trial applications are outlined above:

[1]First application was performed 2 weeks after petal fall (2WPF) on March 20th.

[2]Second application was performed 4 weeks after petal fall (4WPF) on April 3rd.

[3]Third application was performed was 8 weeks after petal fall (8WPF) on May 1st.

# Almond Rust
## *Tranzchelia discolor*

- Rust occurs sporadically throughout almond-growing areas in California.
- It often is serious on young orchards where bloom sprays have not been applied.

**ALMOND—TREATMENT TIMING**

**Note: Not all indicated timings may be necessary for disease control.**

| | | Bloom | | | Spring[1] | | Summer | |
|---|---|---|---|---|---|---|---|---|
| **Disease** | **Dormant** | **Pink bud** | **Full bloom** | **Petal fall** | **2 weeks** | **5 weeks** | **May** | **June** |
| Rust | ---- | ---- | ---- | ---- | ---- | +++ | +++ | +[6] |

**Rating:** +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

[6] Treatment in June is important only if late spring and early summer rains occur.

Micronized sulfur will also show excellent efficacy against Rust

# Phytophthora-Control

- Phosphorous acid has been shown to provide almond trees resistance to *Phytophthora* but may not yet be OMRI approved?

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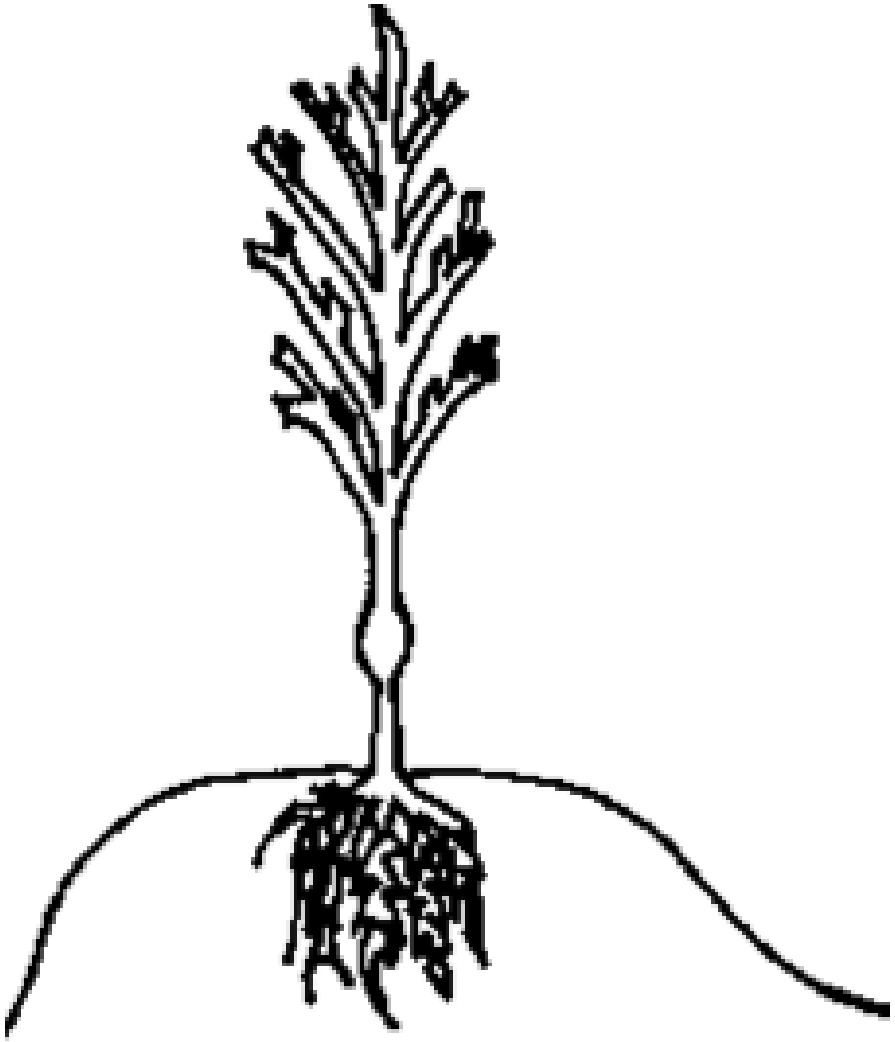
# Phytophthora-Prevention

- Plant trees high on the berm and make sure that the graph union is not buried or touching the soil line



# Crown Gall Control

- *Agrobacterium radiobacter K-84* (Galltrol) is a biological control agent that can be sprayed on roots before planting as a preventative

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# Crown Gall Control

- In orchards with established crown gall infections I would replant with potted trees in the hopes of having less root wounds and entry sites for crown gall

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# Bacterial Canker

- Pre-plant fumigation is important
- Peach/Almond hybrid root-stocks are prone to bacterial canker

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# Hull Rot

*Monilinia fructicola or Rhizopus stolonifer*

# HULL ROT MANAGEMENT

## IRRIGATION

- MAINTAIN ORCHARD AT -7 to -9 BARS
- AT FIRST HULL SPLIT, STOP WATER
- RESUME IRRIGATION AT -14 TO -18 BARS

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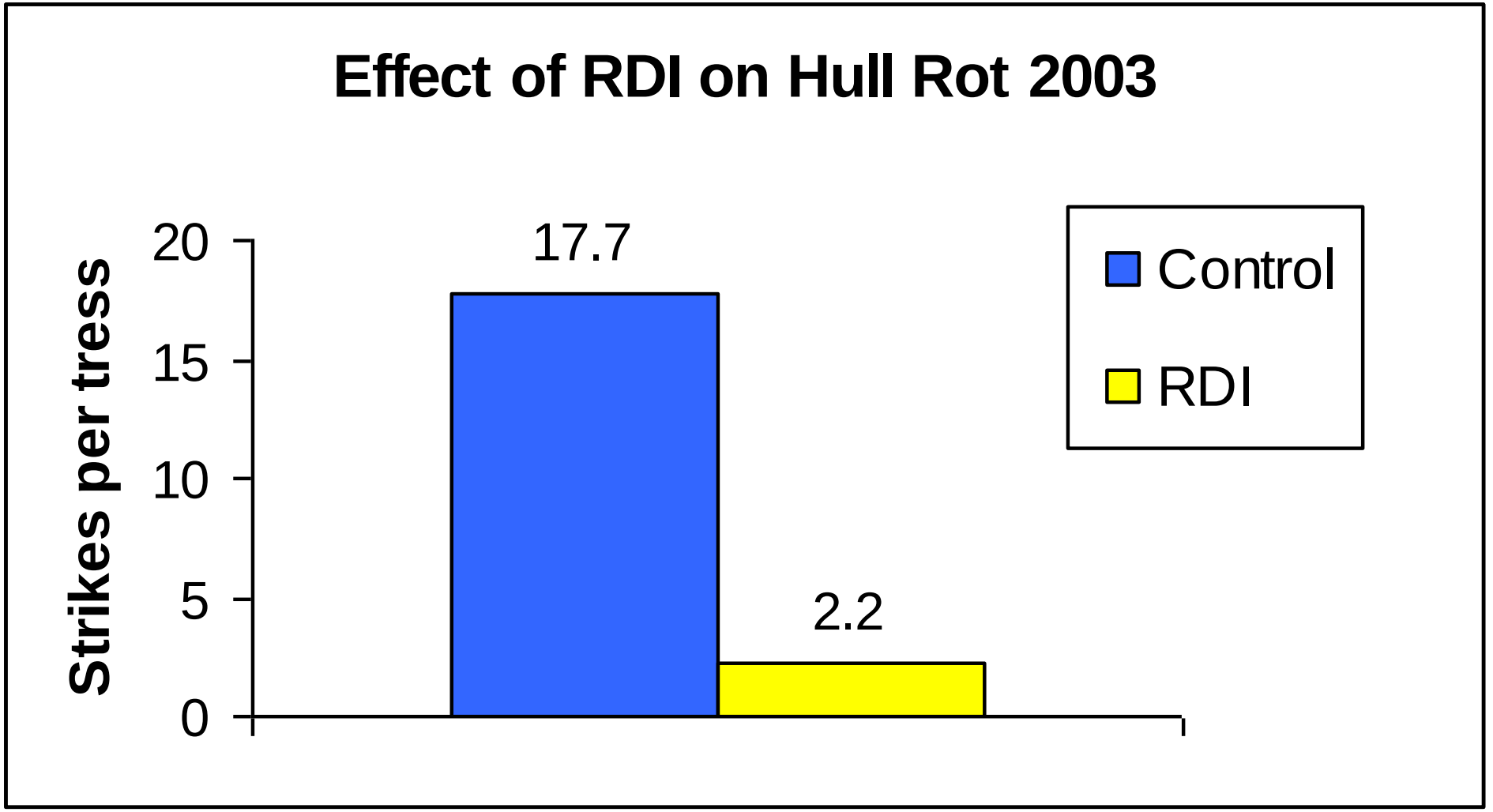


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# Navel Orangeworm Control (NOW)

- Organic growers must diligently practice winter sanitation to destroy over-wintering mummies in order to control NOW


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# NOW Control


- Winter sanitation typically involves winter mechanical tree shaking, hand poling after shaking, and blowing tree rows at a cost of $100-125/acre

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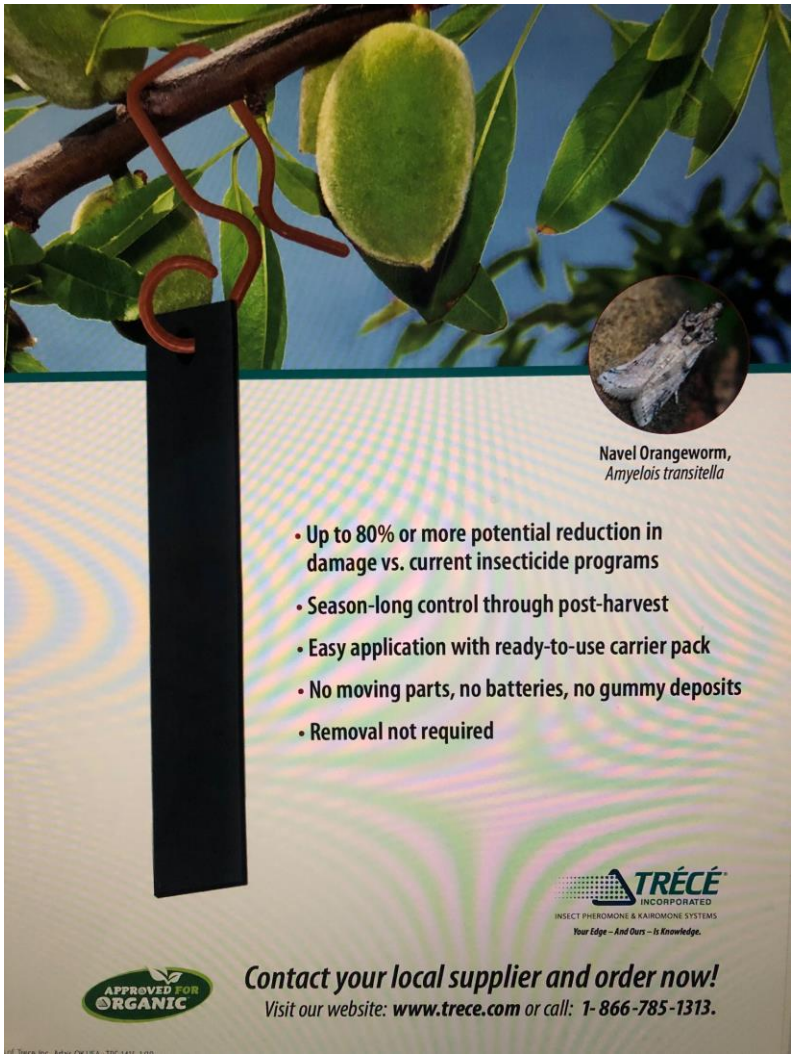
# NOW Control




- Mating Disruption may become a control measure than organic growers will be able to use in the future.
- Meso emmitters have been approved in organic orchards.

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# Mite Control

- Summer oils (OMRI approved) at 2.5 % or 5-6 gals in 200 gallons of water per acre has been a good organic mite treatment
- Oils will also knock down apple leaf hopper


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- The release of predator mites and predatory Thrips are an important mite control strategy for organic growers

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You can control Peach Twig Borer with sprays in order to avoid strikes on shoots that could become your primary scaffolds, especially in the first year.

Bacillus thuringiensis at bloom, or spinosad (Entrust) after bloom are organically acceptable

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# Organic Almond Production—a trade off

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**2016**

SAMPLE COSTS TO PRODUCE

## ORGANIC ALMONDS

**SAN JOAQUIN VALLEY - NORTH**
SOLID SET SPRINKLER IRRIGATION


| | |
|---|---|
| Brent A. Holtz | UCCE Farm Advisor / County Director, San Joaquin County |
| David A. Doll | UCCE Farm Advisor, Merced County |
| Roger A. Duncan | UCCE Farm Advisor, Stanislaus County |
| Karen Klonsky | UCCE Extension Specialist, Department of Agricultural and Resource Economics, UC Davis |
| Daniel A. Sumner | Director, Agricultural Issues Center, Department of Agricultural and Resource Economics, UC Davis |
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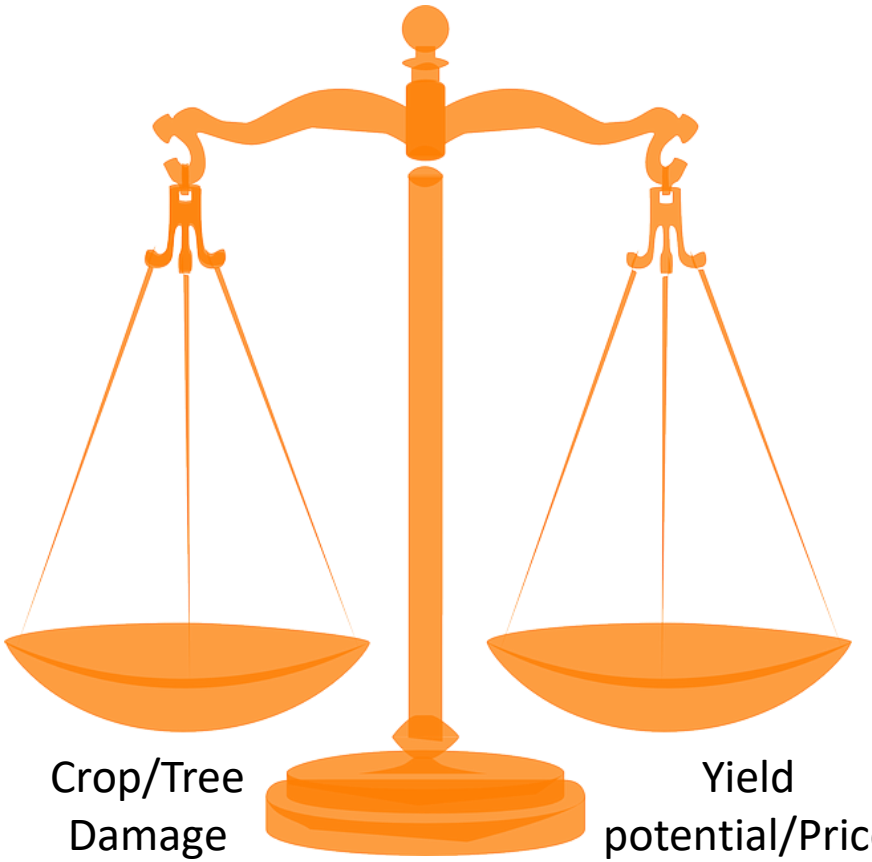


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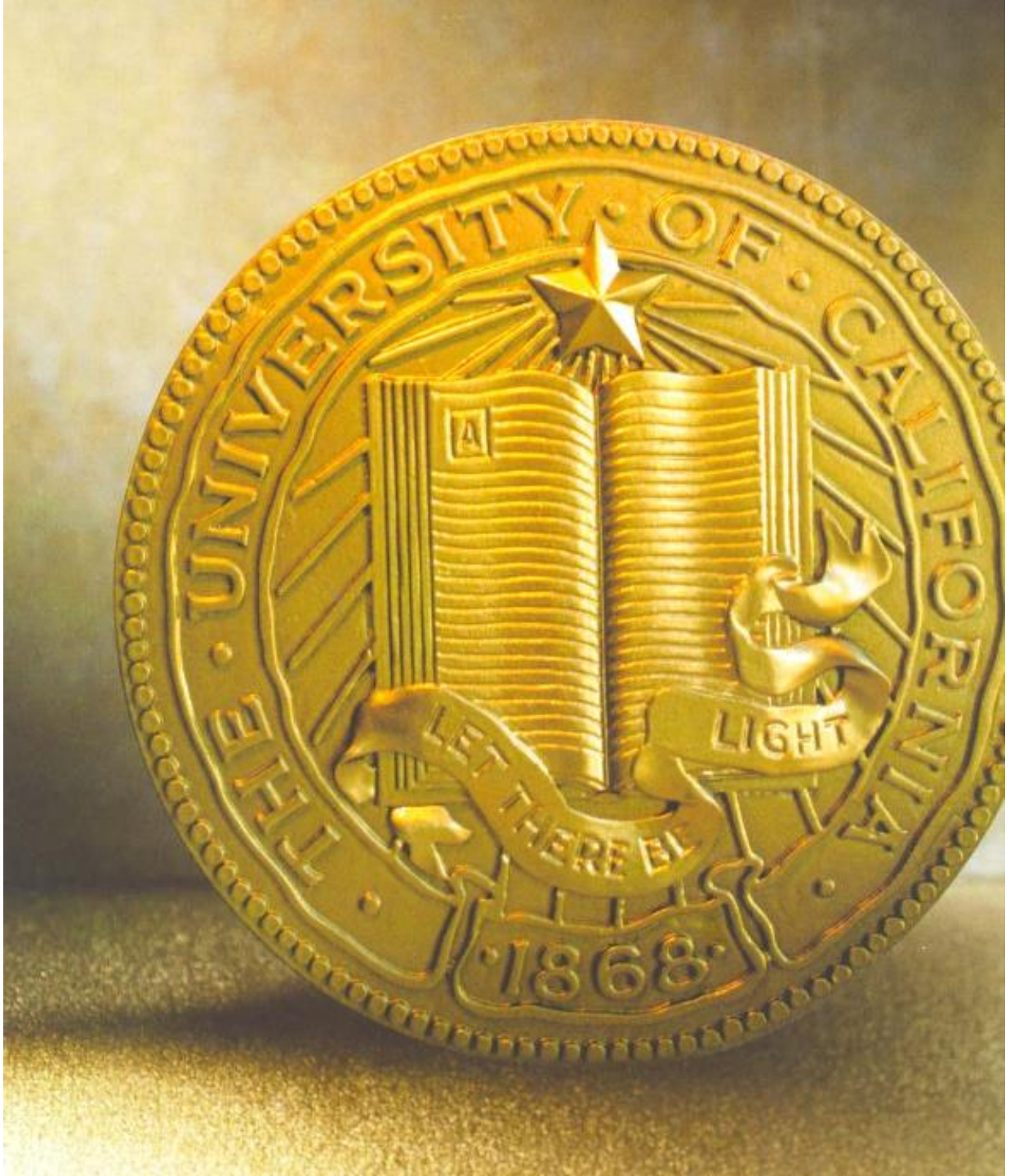


Thank you!
Good Luck!