

# Garden Vegetable Pests & Diseases

## How to Grow a Healthy Salsa Garden



University of California  
Agriculture and Natural Resources



Presented by:  
Carolyn Kinnon



The majority of contaminants entering San Diego watersheds come from residential properties.

**The Solution?**

**Integrated Pest  
Management!**

# Integrated **P**est **M**anagement

-  Utilizes several strategies for pest management rather than relying on only one!

- Scientifically based
- Effective for the long term
- Reduces or even eliminates the need for pesticides
- Saves time and money

# IPM Begins With...

**Proper Planting & Cultural  
Care of your garden plants  
Yields Vigorous Growth and  
Maximum Resistance to  
Diseases and Tolerance for  
Insect Damage!**

# Basic Salsa Ingredients

## From Garden to Table



Cilantro



Onions



Peppers

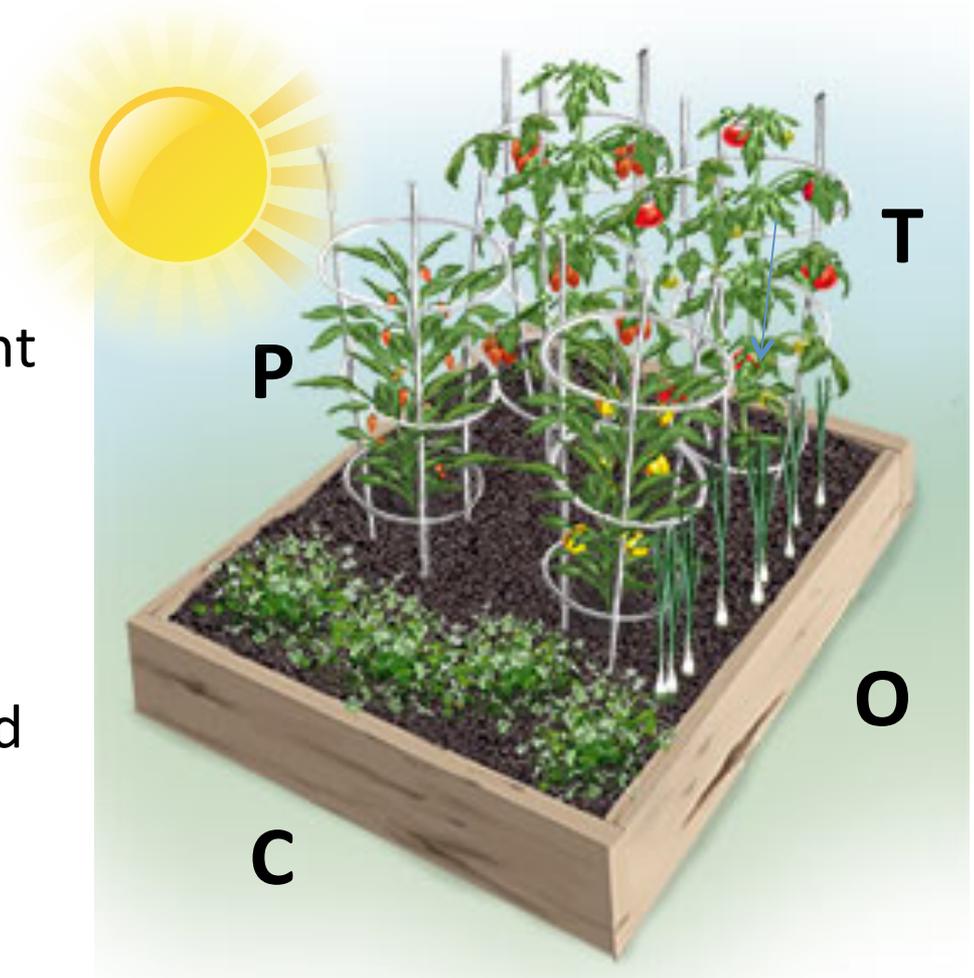


Tomatoes

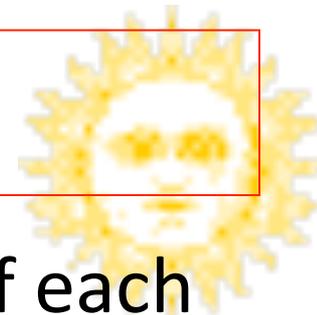
 <p>Tomato x1</p>	 <p>x1</p>	<p>Tomatillo</p>  <p>x1</p>	 <p>x1</p>
 <p>x1</p>	<p>Peppers</p>  <p>x1</p>	 <p>x1</p>	<p>Jalapeno</p>  <p>x1</p>
 <p>x4</p>	<p>Cilantro</p>  <p>x4</p>	 <p>x9</p>	 <p>x9</p>
 <p>x4</p>	 <p>x4</p>	<p>Onion</p>  <p>x9</p>	 <p>x9</p>

# Plan Ahead for Proper Planting

- Garden Space
  - Size of growing bed
    - Plant Size
    - Number of each plant
    - Full Sun
      - Direction of Sun
- Soil Preparation
  - In-ground or Raised Bed
- Irrigation
- Nutrition



# Garden Space



- Size of garden bed determines number of each plant
  - A 4'x4' bed should accommodate 2 dwarf or one bush-type tomato, 2 peppers, 6 cilantro, and 12 onion and/or garlic bulbs
- All plants should be in full sun, 6-8 hours per day
  - Avoid planting near walls or fences that face sun all day to avoid excessive heat reflection to plants
- Plant larger plants “behind” smaller plants to avoid shading

# Room to Grow Largest Plants

## Tomatoes

Choose 1 or More  
for the **SIZE** of your garden



- **Determinate Habit**
  - “Bush” types stop growth at about 3 – 5 feet then set fruit
- **Indeterminate Habit**
  - Need larger garden area
  - “Vine” types tend to sprawl and require more room & support
- Container or Raised-Bed  
Midget, Patio, Dwarf are compact
  - Usually short lived, quick fruit production
- Cherry Tomatoes:  
Dwarf to over 6 feet tall

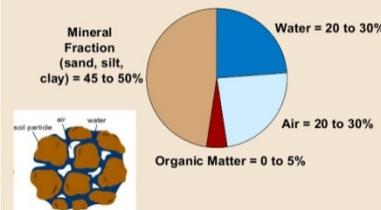
# Soil



## In-Ground Beds or Raised Beds

- Medium-textured (sandy-loam), soft, well-drained soil is best for the mixture of plant types in this garden
- Light sandy soils or heavy clay soils are harder to work with but can be made easier with organic amendments
  - Well composted materials low in salt or bagged
- Avoid areas with rocks, high salinity, or excessively dense clay

“Ideal” composition of a soil



# Soil Preparation

## Water-Wait-Cultivate

### In-Ground Bed

- Prior to cultivation, make sure the soil is moist but not thoroughly wet:
  1. Cultivate the top 1 to 2 inches, rake the area to remove weeds and old crop debris; dig out roots
  2. Irrigate the plot deeply to encourage germination of weed seeds; WAIT!
  3. Cultivate to kill weed seedlings
  4. Amend soil with Organic Matter

### Raised Bed

- After preparation of ground soil:
  1. Form soil into raised bed and plant while soil is still moist
- OR Empty pre-bagged soil into raised bed, leaving enough room to plant & water without spilling over sides

Be sure to break up the clods in the soil, as seeds planted in cloddy soil will germinate poorly, and roots nor seeds will live long because the soil dries too quickly!

# Proper Planting for a Healthy Start

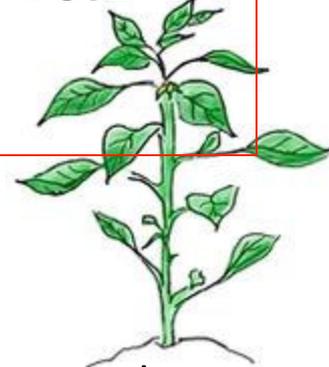


## Tomatoes

- Home-grown or purchased seedlings should be 6-8 inches tall, hardened off, stocky, and well covered with healthy green leaves
- Water thoroughly a couple of hours before planting out and plant in afternoon to minimize water loss during cool overnight hours
- Vigorous seedlings can be planted 2 inches deeper than they are in the pot
- Avoid damaging roots and bruising stems
- Water thoroughly to settle soil and eliminate air pockets

# Proper Planting for a Healthy Start

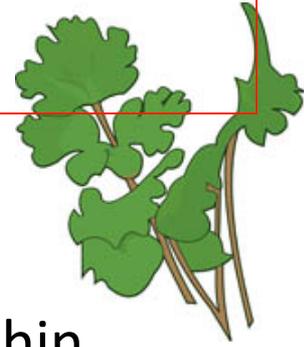
## Peppers



- Are best planted in raised beds
- **Direct Seeding:**
  - Follow directions on seed packet for spacing, depth, time to germination, and thinning of germinated seedlings
  - Keep soil moist during the germination period
- **Transplants:**
  - Water thoroughly a couple of hours before planting out and plant in afternoon to minimize water loss during cool overnight hours
  - Vigorous seedlings should be planted to the depth of the first leaf on the stem, about 18 to 24 inches apart
- A high phosphorus, granular fertilizer should be applied to Pepper seedlings when 4-6 “true leaves” are fully mature, or mixed with back-fill soil in the planting hole for transplants
  - Water thoroughly after transplanting to settle soil, eliminate air pockets

# Proper Planting for a Healthy Start

## Cilantro



- Seed (Coriander) may need to be cracked or scarified before planting
- Plant seed 1/2 inch deep (in rows 12 inches apart) and thin seedlings to 6 to 8 inches between plants after germination.
- Cilantro plants are sensitive to heat, and will bolt to seed quickly in warm weather
  - Can re-seed every three weeks through to cool season for continuous production OR
  - Cut stems one inch above the ground and allow plant to re-grow for a second cutting
  - Harvest the outside leaves and plants will continue producing new foliage until gone to seed
- Plant cilantro transplants 6 to 8 inches apart at same soil level as in container

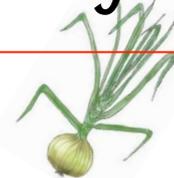
# Proper Planting for a Healthy Start

## Onions



- Onions produce better from seed or transplants rather than from onion sets
- Plant seed about 0.25 inch deep and maintain good soil moisture
  - Plant more seeds than necessary and thin seedlings, saving the strongest seedlings to produce bulbs, at about 4-5 inches apart
- Soil should cover the base of the developing bulb just enough to anchor it in place

## Garlic



- Most **garlic** is grown from “cloves” rather than from seed. Plant the cloves directly in the garden
- Do not break apart the mother bulb until ready to plant
- Do not remove the papery “tunic” from the cloves
- Plant 2 inches deep, 4 inches apart in the row (with 12 inches between rows)
- The larger the clove, the larger the bulb of garlic at harvest

# Proper Cultural Care for Continued Healthy Growth

- Continue with proper cultural practices to promote healthy plants with better resistance to pests and disease....
  - **Proper Watering Practices**
  - **Nutrients; Fertilizing Correctly**

**Healthy plants will have maximum resistance to diseases and greater tolerance for insect damage!**

# Water



- **Water transplants immediately & thoroughly**
- **Maintain even soil moisture**
  - Do not fluctuate between heavy watering and drying out periods
  - Course mulch 3-4 inches thick will minimize fluctuations in soil moisture
  - Do not over-water
- **Avoid “Fixed Schedule” Watering - Water as needed!**
  - Do not stress plants by allowing them to wilt
  - Water deeply fewer times per week
  - Determine soil moisture with a “feel test”
    - If water can be squeezed from a handful of soil – its too wet!
    - If soil does not hold together (loosely) after squeezing – its too dry!
  - Use a soil probe or moisture meter to determine moisture at root zone of largest plants

# Water Properly



- **Good & Bad of Sprinkler Irrigation**
  - Good for seedlings and Leaching salts
  - Do not apply faster than can be absorbed by soil
    - Use Water Cycling
  - Bad in cool weather
    - Contributes to diseases on fruit and leaf molds
  - Avoid applying water in this manner after fruit begins to ripen



**IMPROPER WATERING IS THE #1  
CAUSE OF POOR PLANT HEALTH!**

# Nutrients



- Primary nutrients required by plants:
  - C, H, O (from air and water)
  - Nitrogen (N), Phosphorous (P), Potassium (K)
  - Calcium (Ca), Magnesium (Mg), Sulfur (S)
- Nutrients are absorbed by roots along with water
- Requirements differ for stages of growth
- Organic soil amendments
- Commercial soil mixes may contain slow release fertilizers
- Healthy, vigorous Tomato transplants should *not* require additional fertilizer until flowering and fruit set are well under way.
- Peppers may thrive from an application of high phosphorous fertilizers at planting.

# Fertilize Correctly



- Direct-sown seedlings may need  $\frac{1}{2}$  strength water-soluble fertilizer every 10 - 15 days
  - Do NOT allow runoff of this fertilizer water!
- For transplants use slow-release fertilizers in the planting hole
  - Usually only N & P (and sometimes K) need to be added to mature plants in garden soils after fruit set
    - “Side dress” and Don’t Apply Excess (Follow Label Directions)
    - Indeterminate (Vining) type Tomatoes need more N than Determinate (Bush) type
  - Calcium (Ca) is usually sufficient in garden soils for Tomatoes
    - Water deeply to Leach Salts that may “tie-up” calcium in soil
    - Gypsum is good source if additional Ca is needed

# Too Much or Too Little Nutrition?

- **Excess Nitrogen:**

- Plants more susceptible to insect pests & disease
- Will delay flowering & fruit set
- Flower Drop and Failure to Set Fruit



**Phosphorus-deficient**



- **Lack of Nitrogen:**

- Older leaves are yellowish; new growth sparse, undersized; plants grow slowly and foliage may drop

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- **Lack of Calcium:**

- Blossom End Rot

- Common on sandy soils, soils with high salt



**Potassium-deficient**



# IPM Methods for Controlling Plant Pests

- Prevent Pests & Disease
- Correct Identification of Pest or Disease
- Reduce Population Numbers
  - Apply Appropriate Control Measures
- Recognize Natural Enemies of Pests
  - Encourage Natural Enemies

# Soil-borne Diseases & Nematodes

## Identification, Prevention & Control Measures

# *Phytophthora* Root Rot



- *Phytophthora* requires warm, moist soils in order to cause disease of herbaceous plants.
- Flooded and saturated soil can spread *Phytophthora* to healthy plants.
- Symptoms
  - Leaves of plants affected by *Phytophthora* rot appear drought stressed
  - Leaves may turn dull green, yellow, or in some cases red or purplish
  - When Tomatoes and Peppers are affected, roots of all sizes develop water-soaked spots that dry out and turn a chocolate brown; outer root tissue may come off

# *Fusarium & Verticillium Wilt Diseases*

- Wilt symptoms often appear first on one side of a plant (above ground)
- **Choose Varieties developed for Disease Resistance:**
  - Look for the “Disease Identification Codes” (V, F, FF) on the plant label or seed packet.

Verticillium - Pepper



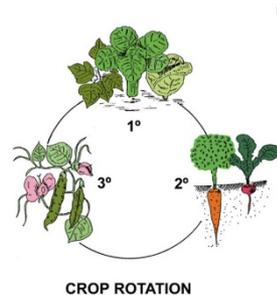
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Fusarium - Tomato

# Controlling Soil-borne Diseases & Nematodes

- Soils should be clean as possible to avoid Disease Pathogens & Nematodes
- Crop Rotation
- Clean soil and debris from tools, shoes
- Make sure debris from previous crops has decayed completely if left in soil

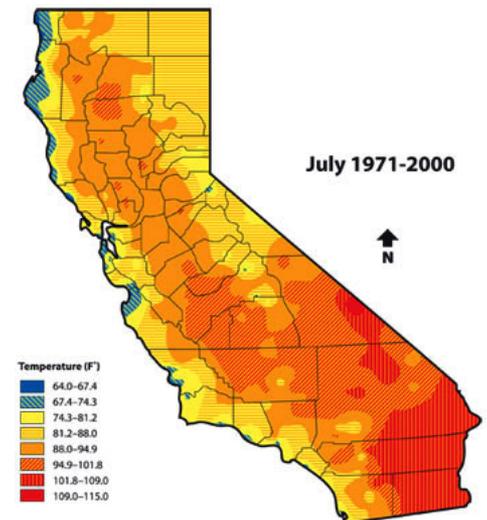


Look for Disease Code (N) on plant labels that indicates resistance to root nematode

Stem & Bulb Nematode on Onion and Galls on roots caused by Root Knot Nematodes.

# Controlling Soil-borne Diseases & Nematodes

- **Good Water Management**
  - Avoid over-watering and provide good draining soil
  - Don't spread disease or Nematodes with water run-off
- **Avoid applying excessive fertilizer**
- **Soil Solarization**



# Leaf Fungi & Weeds

## Identification, Prevention & Control Measures

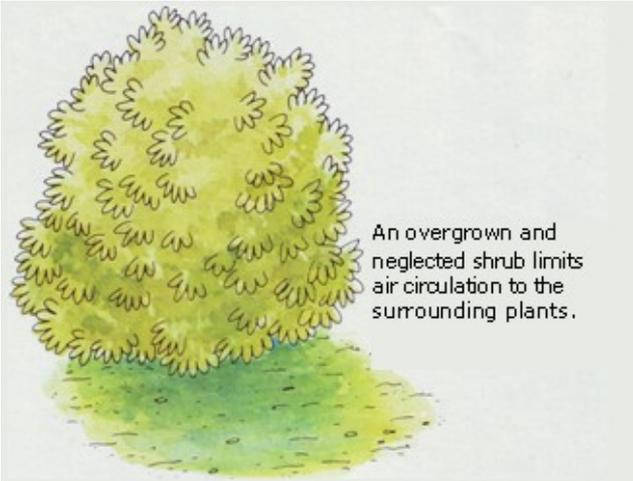
# Powdery Mildew Disease

- Affects all plants in this garden except Onion/Garlic
- Look for resistant plant varieties
- To eradicate mild to moderate powdery mildew infections
  - Use a horticultural oil, or one of the plant-based oils such as Neem oil or Jojoba

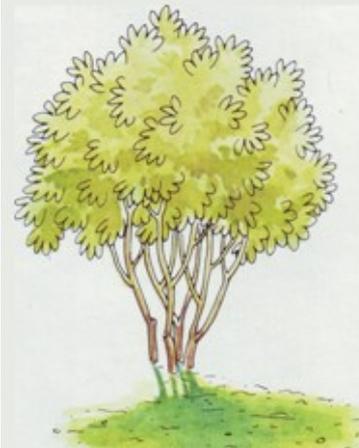


Moderate temperatures (60 - 80°F) and shade encourage the disease!

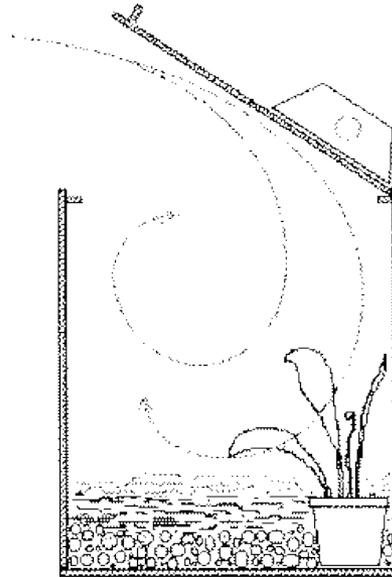
# Controlling Powdery Mildew



An overgrown and neglected shrub limits air circulation to the surrounding plants.



Pruning to raise the canopy and eliminate tangled branches not only permits more air and light but also usually makes the shrub more attractive.



Biological Fungicides are commercially available beneficial microorganisms formulated into a product that, when sprayed on the plant, inhibit or destroy fungal pathogens – *Bacillus subtilis*

# Weeds

- Can quickly shade out young crop plants as well as rob the soil of nutrients and water
  - Control is essential, especially when the crops are young
- Are hosts for diseases & insect pests



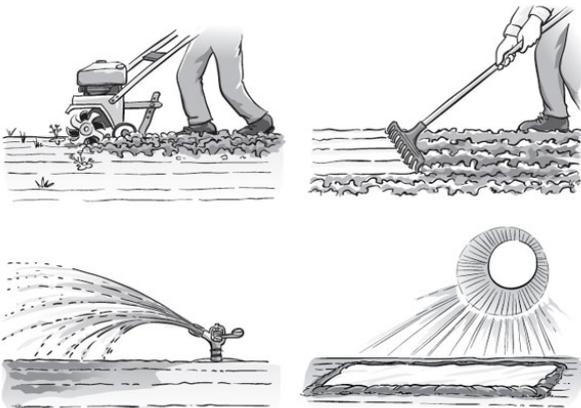
Nettleleaf goosefoot  
hosts Beet Armyworm



Black nightshade  
hosts bacterial spot

# Controlling Weeds

The primary methods for weed control in vegetable gardens include:



- Exclusion & Prevention
  - Never let weeds go to seed in your garden or in areas surrounding your garden.
- Hand-weeding and Hoeing
  - **The most important weed management option in the home garden!**
- Mulching
  - use a coarse-textured mulch with a low water-holding capacity.
- Solarization
  - With clear plastic

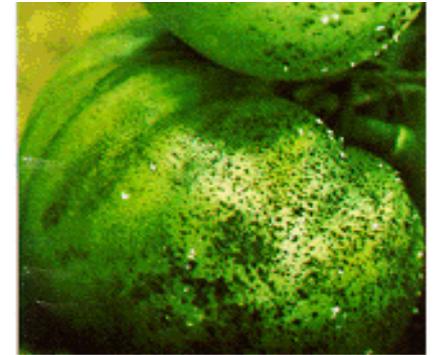


# Insect Pests & Snails and Slugs

## Identification, Prevention & Control Measures

# Be on the Lookout, Be a Scout!

- Aphids on new terminal growth, Whitefly under leaves, Thrips, and Sooty mold on leaves and fruit



- Leafminer “mines”, Hornworms in early season, Snails & Slugs



# Bugs to Watch For



These are NOT Ladybeetles!

## Bagra-da Bug

“Largest numbers are typically observed in organic farms, community gardens, and residential vegetable gardens... Causes feeding damage on the fruits of bell pepper, melon, papaya, tomato...”



CHECK PLANTS REGULARLY &  
HAND-PICK OR VACUUM OFF!

**Use Soapy Water!**

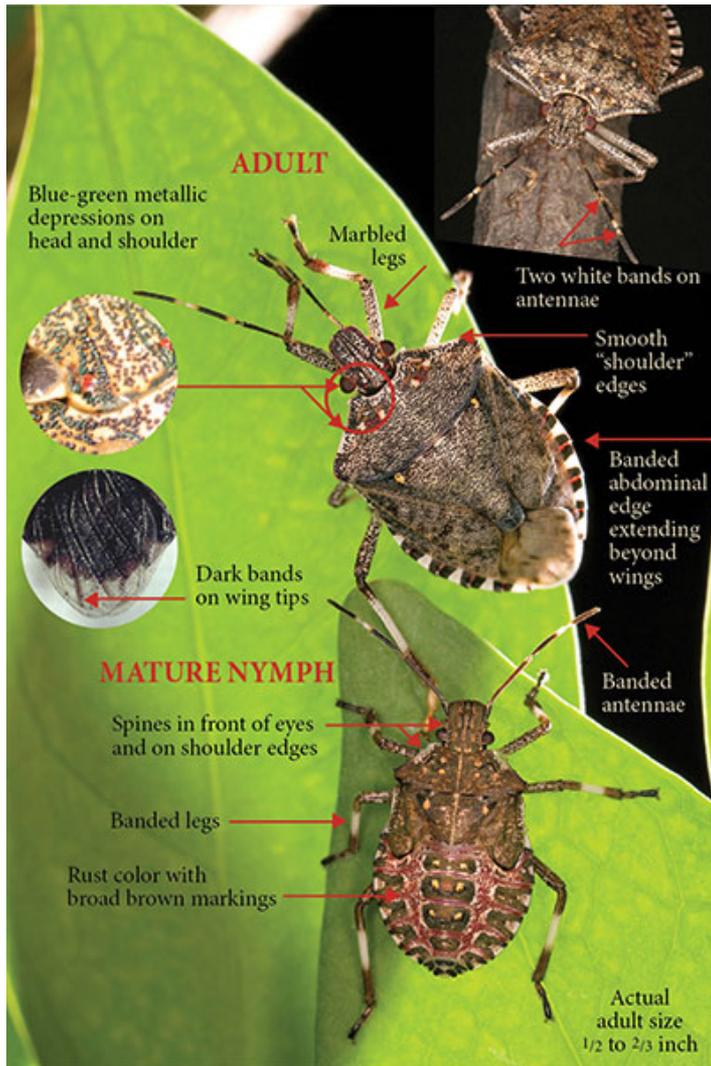


<http://www.ipm.ucanr.edu/EXOTIC/index.html>

<http://cirs.ucr.edu/pdf/bagra-da-bug-capca-handout-sept-19-2012.pdf> © 2014 Regents of the University of California

# Bugs to Watch For

## Brown Marmorated Stink Bug



**BMSB** may reach very high numbers, and since one bug can feed on many fruit, losses can be severe. Adults and nymphs suck juices from fruit and seeds.

**BMSB** damages fruits (citrus, fig, berries, grapes, beans, tomatoes, and other vegetables).



Seeks winter shelter, and large numbers may congregate on outside walls or invade homes by entering through small openings. Can also be hidden inside dense foliage layers or fruit clusters, and tend to hide or drop when startled.



**Avoid damage with floating row covers**

Control Options:

- Handpick or brush off plants into soapy water.
- Use a hand-held vacuum regularly!
- Be sure to destroy the egg masses found on the underside of leaves.

# Managing Insect Pests & Others

## Focus on the Long-Term Goal vs. Short-Term Satisfaction

### • Manage Aphids, Leafminers, Whitefly, & Thrips

- By identifying and allowing their natural enemies to prey on or parasitize them
- Aphids can be picked off/squashed by hand or knock Aphids and Thrips off with spray of water
- Whitefly populations can be reduced by pruning to allow good air circulation
- Clip off and remove older leafminer infested leaves
- **Use Insecticidal Soaps and Horticultural Oils**
- Other more toxic pesticides are not effective and may cause increased populations of these insect pests by killing their natural enemies!

### • Manage Worms, Loopers, etc., & Bagrada Bugs or BMSB

- By hand picking or vacuuming and dumping into soapy water
- Microbial products like *Bt* for worms
- Moderate numbers of Loopers and Hornworms can be beneficial hosts for parasites that attack Tomato Fruitworms
- Destroy egg masses of BMSB
- **Trap Snails & Slugs**
- Use copper strips around upper edges of raised-bed & collect them for disposal.
- Put hollowed-out cantaloupe rind upside down, dispose of collected snails/slugs

# Beneficial Natural Enemies of Vegetable Pests

## Focus on the Long-Term Goal vs. Short-Term Satisfaction



Lady Beetle Adult & Larva



Green Lacewing Adult & Larva



Minute Pirate Bug



1/4 inch long



1/8 to 4/5 inch long



Predators of Snails & Slugs



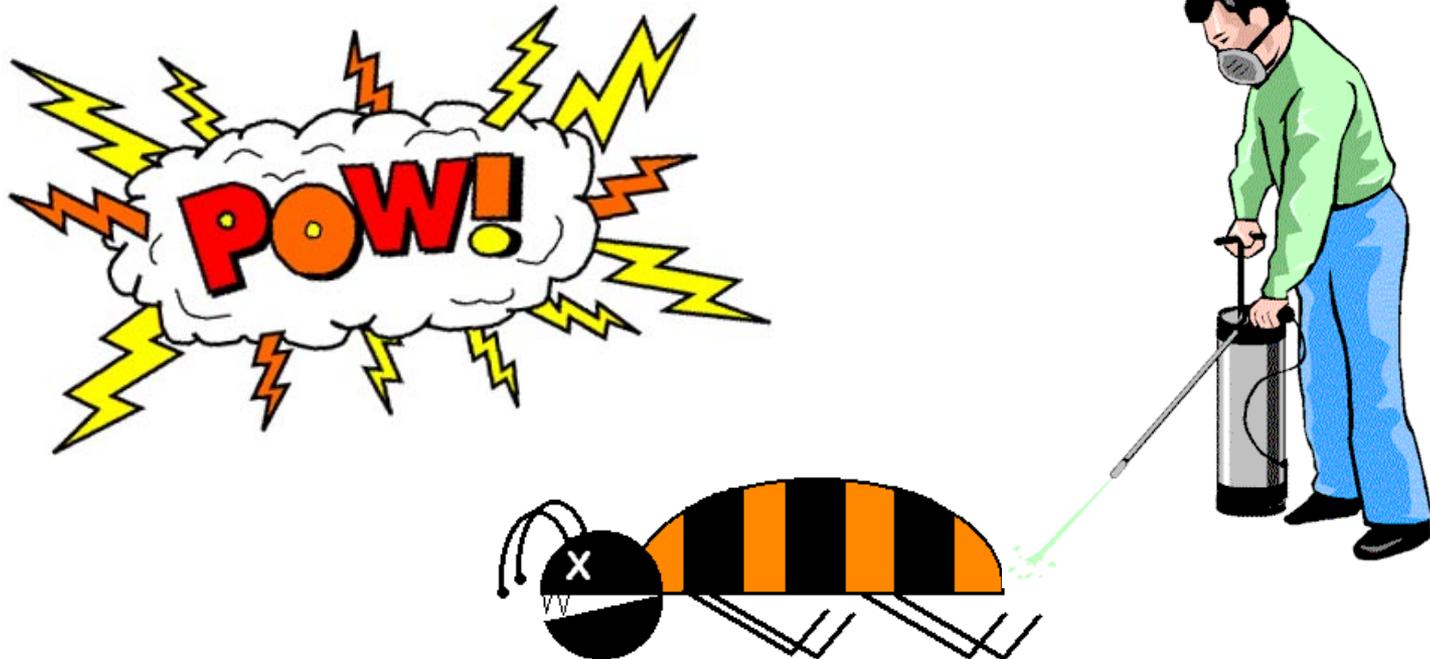
Devil's Coach Horse & Decollate Snails

**Conserve these organisms! Use non-chemical or least toxic pest control methods!**

# Short-Term Satisfaction *costs* everyone!

Besides not being effective over the long-term:

1. Pesticides are expensive.



## 2. If applied incorrectly, pesticides can have toxic affects on non-target organisms.



•Children



•Pets

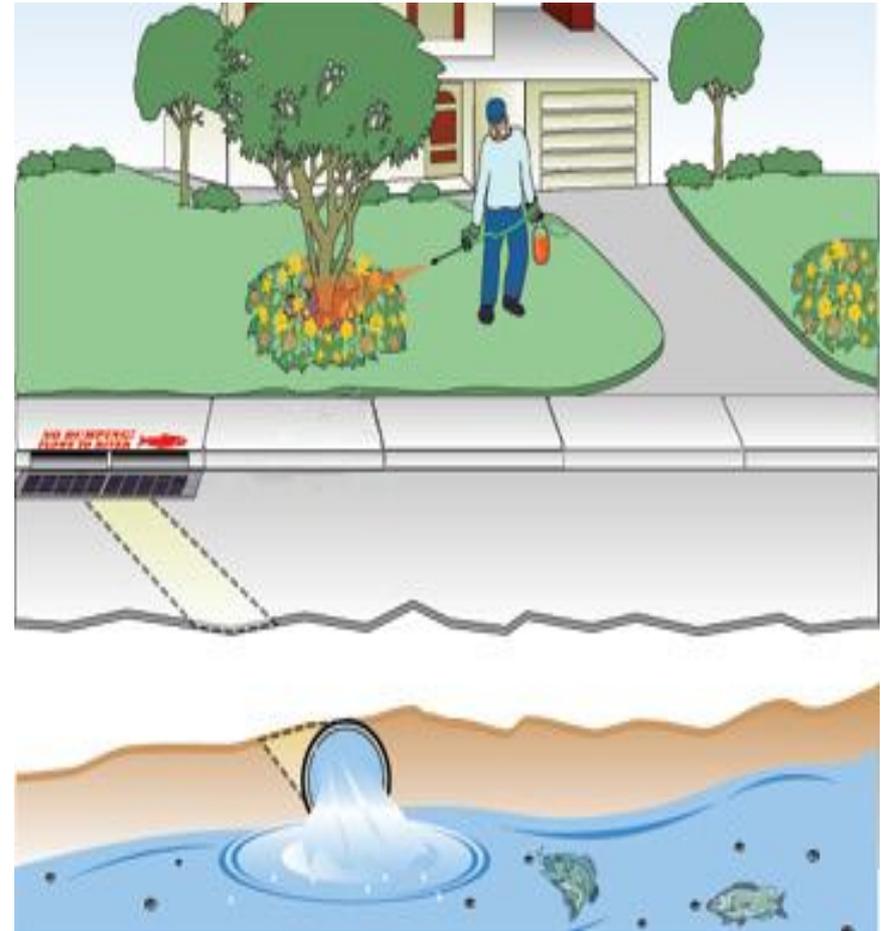
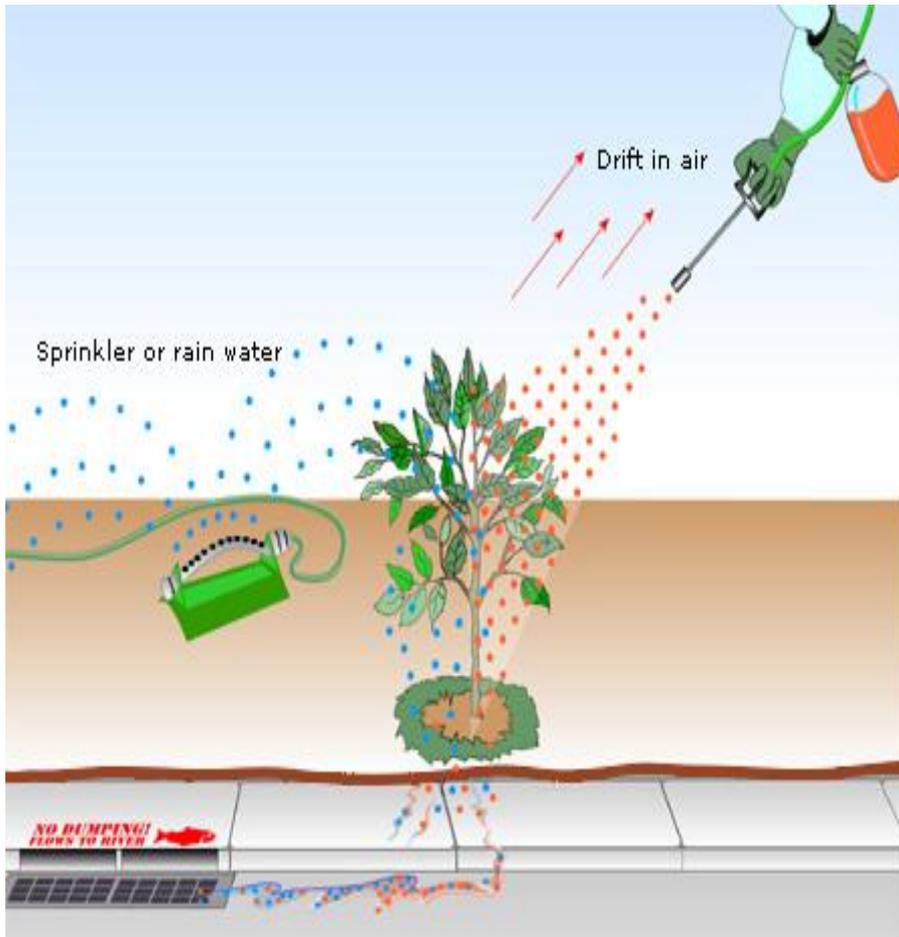


•Beneficial Natural Enemies



•Plants

**3. When pesticides are applied to our homes, gardens, and landscapes they may drift in the air or be washed into a storm drain by irrigation or rain.**

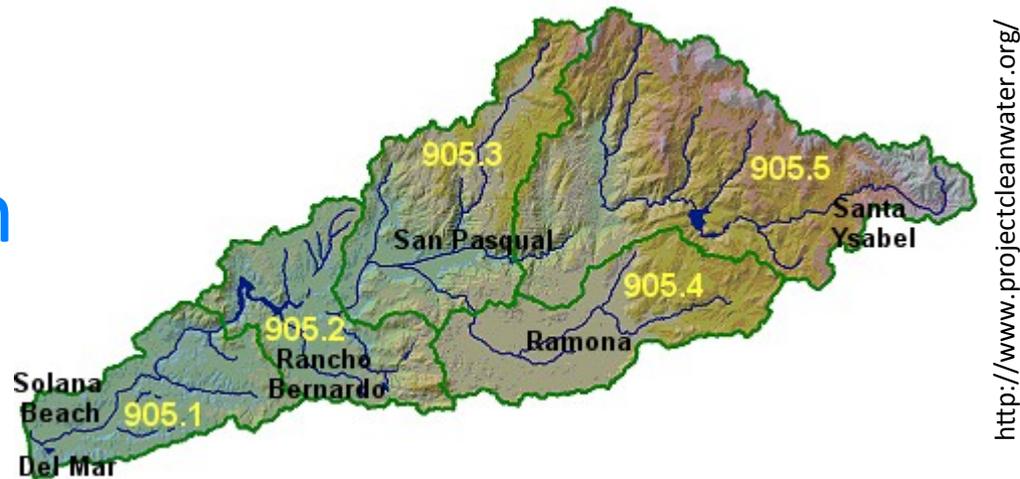


# Our Watershed

## Provides Water Resources

- Municipal & Domestic Water Supply

- Recreation



<http://www.projectcleanwater.org/>

San Dieguito River Watershed

- Wildlife and Estuarine Habitat

# Use Pesticides Correctly and Safely

- Use the least toxic chemical that will control the pest
  - Insecticidal Soaps and Horticultural Oils
- READ THE LABEL to make sure the target pest is controlled
- READ THE LABEL for possible toxicity to plants and effects on beneficial organisms
- Spot spray
- Avoid Drift



# Reading a Pesticide Label

Active Ingredient

Azadirachtin.....4.38%

Inert Ingredients.....95.62%

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**

See back panel for  
additional  
precautionary  
statements.

**NET CONTENTS 32 FL OZ (1QT) 946mL**

Azadirachtin is derived from the natural oil found in seeds of the Neem tree.

# It's The Water That Connects Us!

- Read Pesticide Labels and Follow Directions to the Letter!
- Store Pesticides in a Safe Manner
- Dispose of Unused Pesticides Properly



# Useful Phone Numbers:

- Unused Pesticide Disposal: 1-800-CLEANUP
- Master Gardner Hotline: (858) 822-6910
- UC Cooperative Extension: (858) 822-7711
- Agricultural Commissioners'  
Office: (858) 694-2739

## **Resources for this presentation include:**

Integrated Pest Management for Tomatoes. Fourth Edition.  
Revised: Strand, Larry L., University of California, Statewide Integrated Pest Management Project. Publication 3274. Regents of the University of California. 1998.

*Growing Tomatoes in the Home Garden*. Pittenger, Dennis R., et al. University of California Division of Agriculture and Natural Resources. Publication 8159.  
<http://anrcatalog.ucdavis.edu>

*UC IPM Pest Management Guidelines: Tomato, Peppers, Onion/Garlic, Cilantro*.  
<http://ipm.ucanr.edu/PMG/GARDEN/VEGES/tomato.html>  
<http://ipm.ucanr.edu/PMG/GARDEN/VEGES/peppers.html>  
<http://ipm.ucanr.edu/PMG/GARDEN/VEGES/onions.html>  
<http://www.rain.org/greennet/docs/exoticveggies/html/cilantro.htm>

UC IPM Online. Statewide Integrated Pest Management Program. University of California. Agriculture and Natural Resources. <http://ipm.ucanr.edu/>

<http://www.projectcleanwater.org>

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# More 2020 Workshops



- **Salsa Gardening**
  - April 25 – Pine Valley Branch Library
- **Herb Gardens for Cooking**
  - May 2 – Rancho San Diego Branch Library
- **Controlling Ants the Healthy Way**
  - May 16 – 4 S Ranch Branch Library
- **Beginning Gardening**
  - June 6 – Spring Valley Branch Library

