Cultural Pest Control For Vegetable Crops

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Cultural Control & IPM

- Integrated Pest Management
- IPM is a sustainable approach that combines the use of prevention, avoidance, monitoring, and suppression strategies in a way that minimizes economic, health, and environmental risks.

~USDA-CSREES 1998~

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IPM Timeline

1. Pre 1940's (pre-WW2) → multiple tactics used to limit pest damage
2. Post WW2 → chlorinated hydrocarbons (e.g., DDT), organophosphates, etc.
3. 1940's-1960's: Golden Age of Insecticides
4. 1962: Rachel Carson publishes 'Silent Spring'
5. 1970: EPA established
6. Integrated Pest Management

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Cultural Controls & IPM

- Prevention
  - Removing food, water, shelter
- **Cultural Controls**
  - **Resistant varieties, altered planting dates, crop rotation, sanitation**
- Biological Controls
  - Use of natural enemies to control a pest
    - Predators, parasitoids, pathogens
- Mechanical/Physical Controls
  - Vacuuming, handpicking, row covers
- Chemical Controls

Integrated Pest Management

- A pest is any organism that interferes with the interests of humans, such as food, fiber, and health
- A plant, fungus, or animal that is out of place
  - Properly identified via scouting
- IPM combines pest control tactics to be:
  - Preventative and curative
  - Economically sound
  - Environmentally responsible
  - Meets needs of society

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What Isn't A "Pest"

- Abiotic "pests"
- Environmental
  - Nutrient imbalances
  - Water imbalances
  - Toxic chemicals
  - Temperature extremes
  - Mechanical injury

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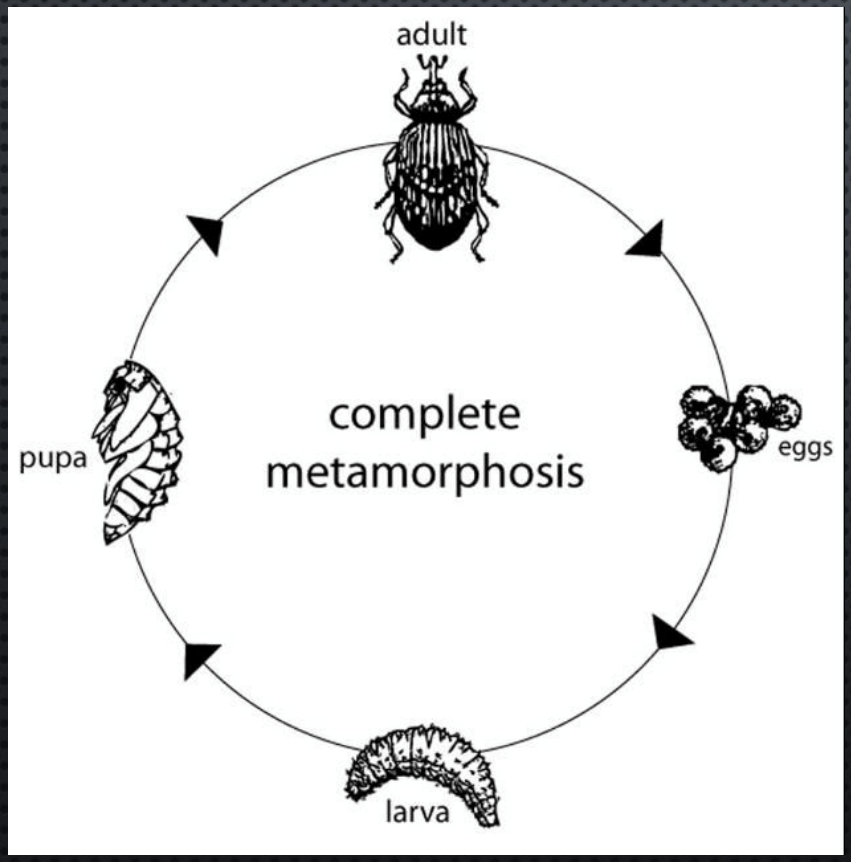
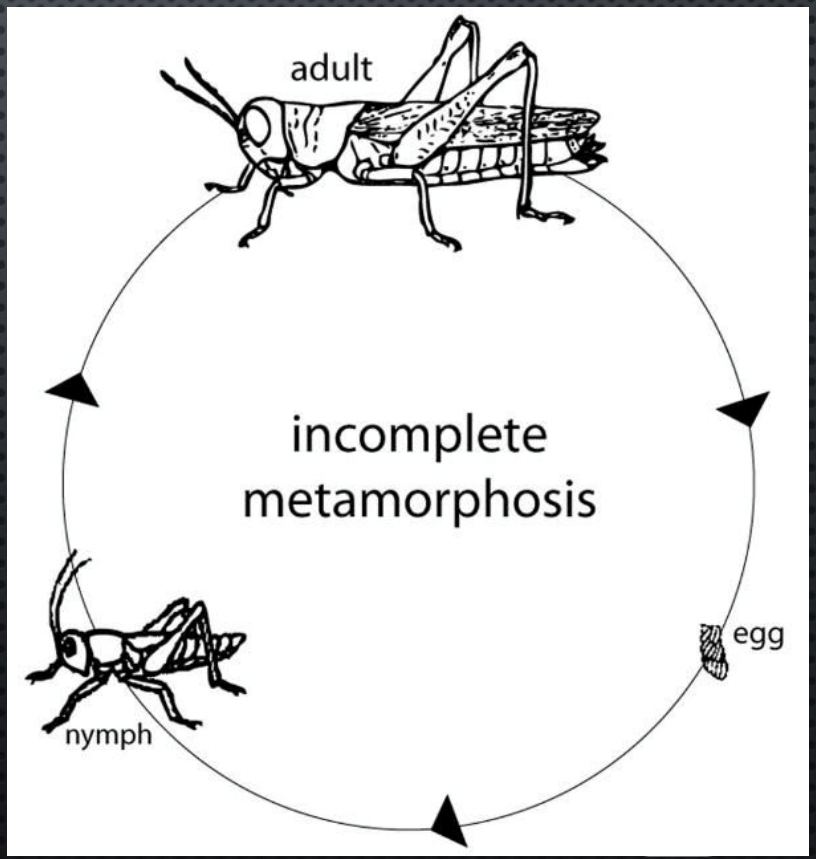
Insect Pest Life Cycles





Cultural Control

- Create a growing environment unsuitable for pests
- Select the right plants from the beginning
  - healthy, well-adapted, pest free
- Good horticultural practices:
  - Site selection
  - Fertility
  - Sunlight, water
  - Pruning
- Sanitation
  - Cleaning up debris (hiding places) and dead plants to reduce overwintering survival
- Host plant resistance
  - selecting plants tolerant or resistant to pests

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Cultural Control-HPR

- Host Plant Resistance
  - For disease or insects
- Antixenosis (non-preference)

  The inability of a plant to serve as a host; repellent or distasteful to the pest
- Antibiosis

  Plant has adverse effect on pest's survival, longevity, or fecundity
- Tolerance

  Despite pest damage, plant produces a greater yield than would a susceptible cultivar

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Aphids

- Gradual metamorphosis
- Piercing-sucking mouthparts
  - Suck plant sap, produce honeydew (sooty mold)
- Overwinter as winged adults & eggs
- Many hosts
- Some species resistant to insecticides

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Aphids-Cultural Controls

- Many natural enemies present outdoors
  - What has been sprayed?
- Overwintering hosts:
  - Green Peach: spinach, collards, turnip, wild mustard, and dock
  - Potato: wild roses
  - Pea: alfalfa, clover, and vetch
  - Cotton: overwinter in soil or plant debris, but will fly to weedy hosts during warm periods
- Cultural Controls:
  - Reduce nitrogen
  - Remove by hand
  - Wash off plant

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Spider Mites

- Egg, larva, nymph, adult
- Sucking mouthparts (stylets)
- Overwinter as eggs & adults
- Thrive in hot, dry conditions
- Many host plants
- Many are insecticide resistant

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Spider Mites-Cultural Controls

- Reduce nitrogen
- Adequate irrigation
- Wash off plant with firm stream of water
  - Focus on undersides of leaves
- Eliminate dust on plants
- Reduce weeds that can harbor mites
  - Field bindweed, morning glory, mallow, knotweed

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Crop	lbs. N/acre/year	lbs. N/1,000 ft²/year	lbs. 34-0-0/1,000ft²/year
Asparagus	75	1.72	4.99
Bean	75	1.72	4.99
Beet	120	2.75	7.99
Broccoli, Cauliflower, Cabbage	175	4.02	11.65
Cantaloupe, other melons	125	2.87	8.32
Carrot	175	4.02	11.65
Cucumber	150	3.44	9.99
Corn	200	4.59	13.31
Cowpea	50	1.15	3.33
Eggplant	100	2.30	6.66
Garlic	175	4.02	11.65
Pea	60	1.38	3.99
Leafy Greens	120	2.75	7.99
Okra	80	1.84	5.33
Onion	150	3.44	9.99
Pepper	100	2.30	6.66
Potato	200	4.59	13.31
Pumpkin	150	3.44	9.99
Radish	80	1.84	5.33
Squash	150	3.44	9.99
Sweet Potato	60	1.38	3.99
Tomato	100	2.30	6.66
Turnip	80	1.84	5.33
Watermelon	150	3.44	9.99

Colorado Potato Beetle

- Complete metamorphosis
- Chewing mouthparts
- Feed on potato, tomato, eggplant, others
- Overwinter as adults in the soil
- Resistant to many conventional insecticides

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CPB-Cultural Controls

- Plant early maturing, bushy varieties
  - <80 days
  - More foliage, less easily damaged
- Crop rotation outside of Solanaceae family
  - Adults only crawl short distances
- Only grow potatoes every other year
- Till soil to kill adult beetles
- Remove Solanaceous weeds
  - Ground cherry, nightshade

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Spotted/Striped Cucumber Beetle

- Complete metamorphosis
- Chewing mouthparts
- Feed on cucumbers & other cucurbits
- Overwinter as adults near plants or in debris
- Adults kill seedlings in large numbers
- Larvae feed on roots & fruits contacting the ground
- Transmits bacterial wilt of cucurbits

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Cucumber Beetle-Cultural Controls

- Crop rotation outside cucurbit family
- Avoid planting next to corn
  - Larvae feed on roots
- Grow plants on trellis system
- Remove crop debris
- Till soil to kill adult beetles
- Starting crop by transplants may avoid some damage
- Perimeter and field edge trap cropping
  - Blue Hubbard or other *Cucurbita maxima* variety

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Corn Earworm

- Complete metamorphosis
- Chewing mouthparts
- Feed on corn, tomato, cotton, beans, alfalfa, tobacco
- Overwinter as pupa in the soil
- Pyrethroid resistance?

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Corn Earworm-Cultural Controls

- *Bt* varieties & varieties with tight fitting shucks
- Till after harvest to expose overwintering pupa
- Avoid late planting
  - Harvests in August & September tend to have ears with increased damage
  - Moths from field corn are looking to lay eggs on silks of sweet corn
- Avoid planting near field corn?
- Adults attracted to light

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Cabbage Looper

- Complete metamorphosis
- Chewing mouthparts
- Feed on cabbage, lettuce, spinach, beet, potato, tomato
- Overwinter as pupa on plants
- Feed on lower leaves, often underneath them
- Cabbage can tolerate feeding until cupping stage

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Cabbage Looper-Cultural Controls

- Rotate outside of Cole crops and Solanaceous crops
- Remove crop debris
  - Disking will also damage overwintering pupa
- Reduce excess lighting that attracts adult moths
- Remove weeds of related species/family
  - mustards

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Squash Bug

- Incomplete metamorphosis
- Piercing sucking mouthparts
  - Damage caused by sap removal; toxic saliva cause leaves and vines to wilt
- Overwinter in plant debris or forested areas
- Major sucking pest of squash and pumpkins
- Adults and nymphs may also feed directly on fruit, causing them to collapse
- Transmit cucurbit yellow vine

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Squash Bug-Cultural Controls

- Unmated adults overwinter in crop debris in fields, or in nearby forested areas
  - Remove old cucurbit plants after harvest
  - Keep garden/field free of rubbish and debris that can serve as overwintering sites
  - Compost all vegetation or thoroughly till it under at end of season
- Stagger planting of field
  - When plants infested, remove and destroy
- Start with larger transplants able to withstand more damage before death

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Stink Bug

- Incomplete metamorphosis
- Piercing sucking mouthparts
- Overwinter as adults in leaf litter
- Adults and nymphs may also feed directly on fruit, causing aesthetic damage

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Stink Bug-Cultural Controls

- Clean up plant debris after the season, especially crucifers and legumes
- Tilling disrupts overwintering sites
- Remove desirable weeds: dock, mullein, mustard, thistles, vetch, milkweed, plantain, volunteer wheat
- Thicker skinned tomatoes may resist damage by mouthparts

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In general…

- Soil test yearly for nutrient management
- Rotate crops and plant a cover crop if possible
- Plant a diverse population of many plant species
- Remove weakened or “spindly” plants
- A stressed plant is:
  - more attractive to pests
  - less able to defend itself
  - more likely to suffer injury

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Resources

- Earth-Kind Gardening Series, Cultural Control Practices
  - http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2297/HLA-6431web.pdf

- Sorensen K.A., Mohankumar S., Thangaraj S.R. 2016. Physical, Mechanical and Cultural Control of Vegetable Insects. In: Muniappan R., Heinrichs E. (eds) Integrated Pest Management of Tropical Vegetable Crops. Springer, Dordrecht

- National Sustainable Agricultural Information Service
  - http://attra.ncat.org/

- https://aggie-horticulture.tamu.edu/vegetable/guides/texas-vegetable-growers-handbook/chapter-iv-cultural-practices/

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Questions?

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