Fruit & Vegetable IPM

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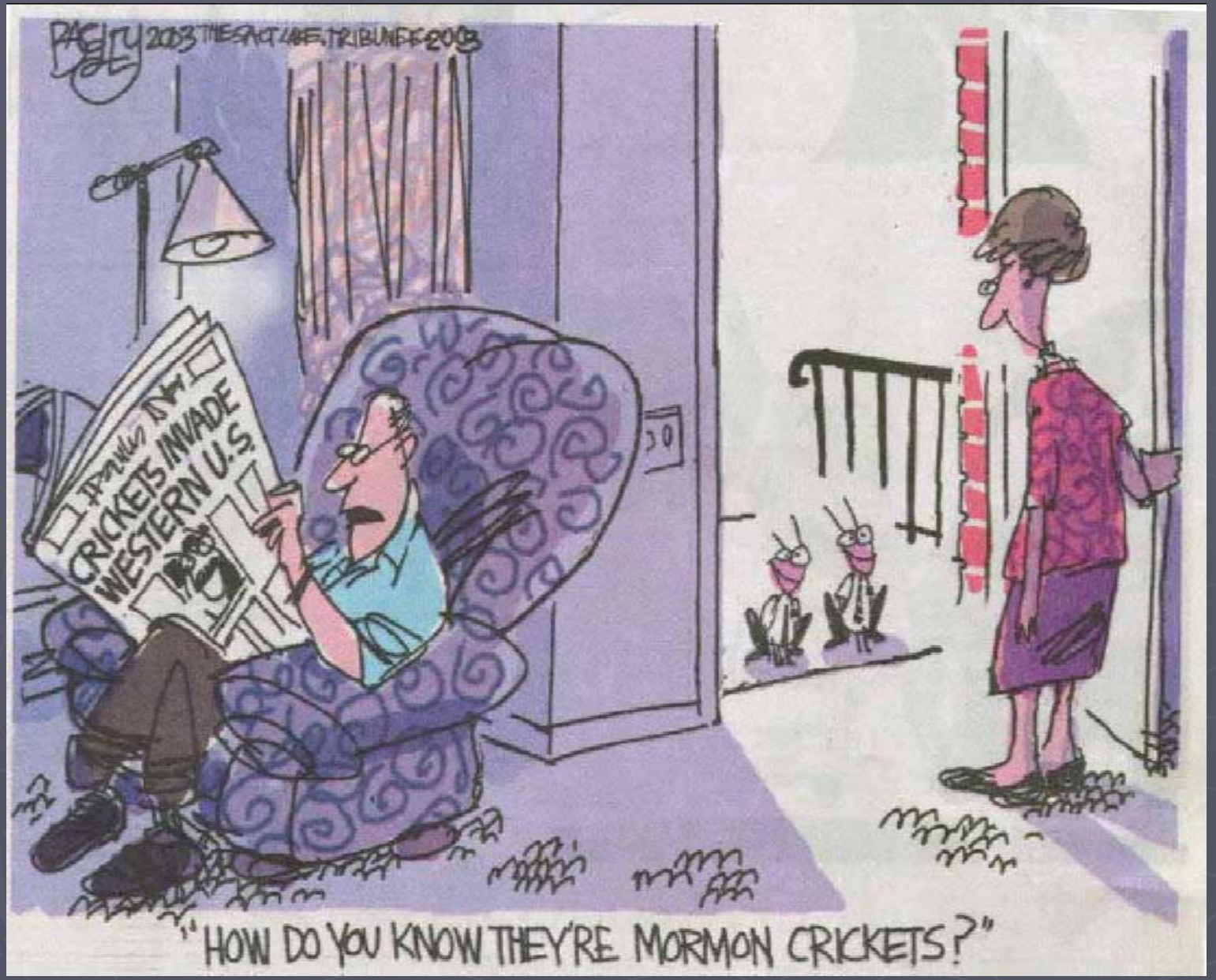
USU Extension Salt Lake County

Outline

- Definition of IPM
- Life Cycles of Insects
- Disease Triangle - Pathogens
- Vegetable & Fruit Insect Pests
- Vegetable & Fruit Disease Pests
- Organic and Softer Insecticides
- Beneficial Insects
- Resources
- Questions


CRICKETS INVADE WESTERN U.S.
"HOW DO YOU KNOW THEY'RE MORMON CRICKETS?"

What is a pest and IPM?

Pest: A general term for organisms which may cause illness or damage or consume food crops and other materials important to humans. An organism that is considered a nuisance to man, most usually having pathogenic properties. *(Biology On-line.org)*

Pest: A life form whose interests conflict with yours.

The definition of IPM from the National IPM Network is the following:

"IPM is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health, and environmental risks."

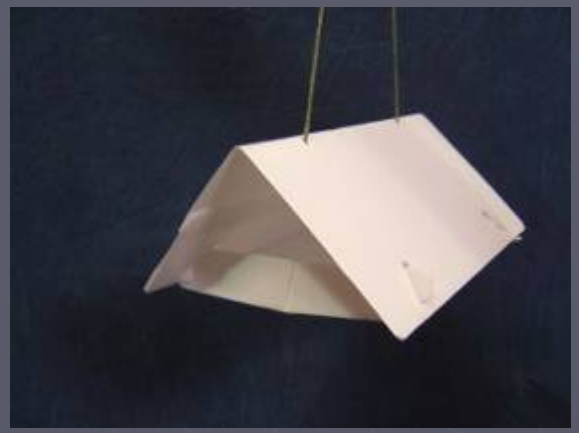
Steps in IPM

- Prevention
- Monitor/Scouting
- Pest Identification
- Action Threshold
- Management Options:
  - Mechanical
  - Biological
  - Chemical Controls

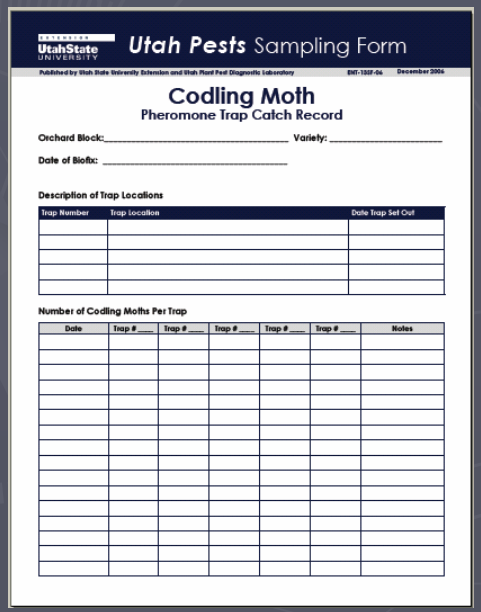
Prevention

- Selecting resistant varieties
- Maintaining healthy plants

Monitor



- Regular observation
- Visual inspection
- insect traps
- Record keeping



Utah State University

Utah Pests Sampling Form

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory — ENT-102F-06 — December 2006

Codling Moth
Pheromone Trap Catch Record

Orchard Block:_____ Variety: _____

Date of Biofix: _____

Description of Trap Locations

Trap Number	Trap Location	Date Trap Set Out

Number of Codling Moths Per Trap

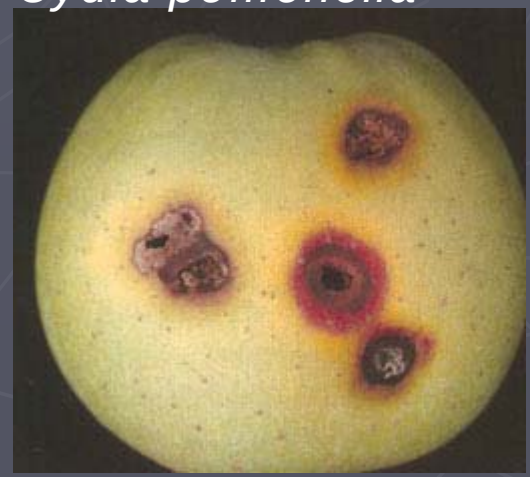
Date	Trap # ___	Trap # ___	Trap # ___	Trap # ___	Trap # ___	Notes

Fig. 5. Stiles-style, ammonia-baited sticky trap.

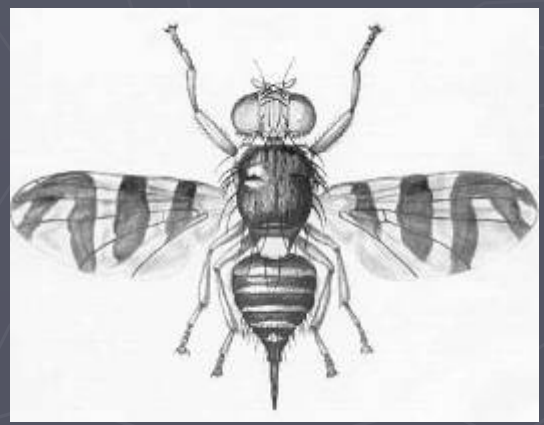
Proper Pest Identification
Name That Pest??

Helicoverpa zea

Cydia pomonella



Name That Pest ??



Name That Pest??

Fire Blight of apple and pear

Action Thresholds

- Emphasis on control, not irradication
- the attempt to eridicate can be more costly, environmentally unsafe, and all-round counterproductive

Why IPM??

- In 1954, a new type of aphid was seen in California. At first, organophosphate pesticides were applied but after 5 years, most of the aphid population had become resistant. The pesticides also killed natural predators of the aphid.
- In the application of IPM, the amount of organophosphate used was lowered to allow the natural predators to live; further predators were also introduced

Tomatoes in Florida

- Tomatoes are the No. 1 vegetable crop in Florida. In 1996-97:
- 37,300 acres were planted;
- 1.4 billion pounds produced (36,700 pounds per acre; and
- Tomatoes earned $462.5 million in on-farm revenues, or 28.9 percent of the value of all Florida vegetables.

Tomato IPM in Florida

Growers have used 25 years of tomato IPM in Florida:

- **Yields have risen dramatically** from 29,000 to 36,700 pounds per acre in only 8 years (1988-89 to 1996-97).
- **Fifty percent of growers routinely scout** for pests.
- Growers using IPM report **82 percent reduction in overall pesticide use**.
- **Insecticide use has been significantly reduced** from an average of 8.9 pounds per acre in 1994-95, to 3.5 pounds per acre in 1996-97.
- **A shift toward using reduced-risk pesticides** is evident throughout Florida.
- **New scouting companies** with highly trained personnel have developed.
- Scouting actions have **detected outbreaks** of new and unusual diseases, enabling early intervention.

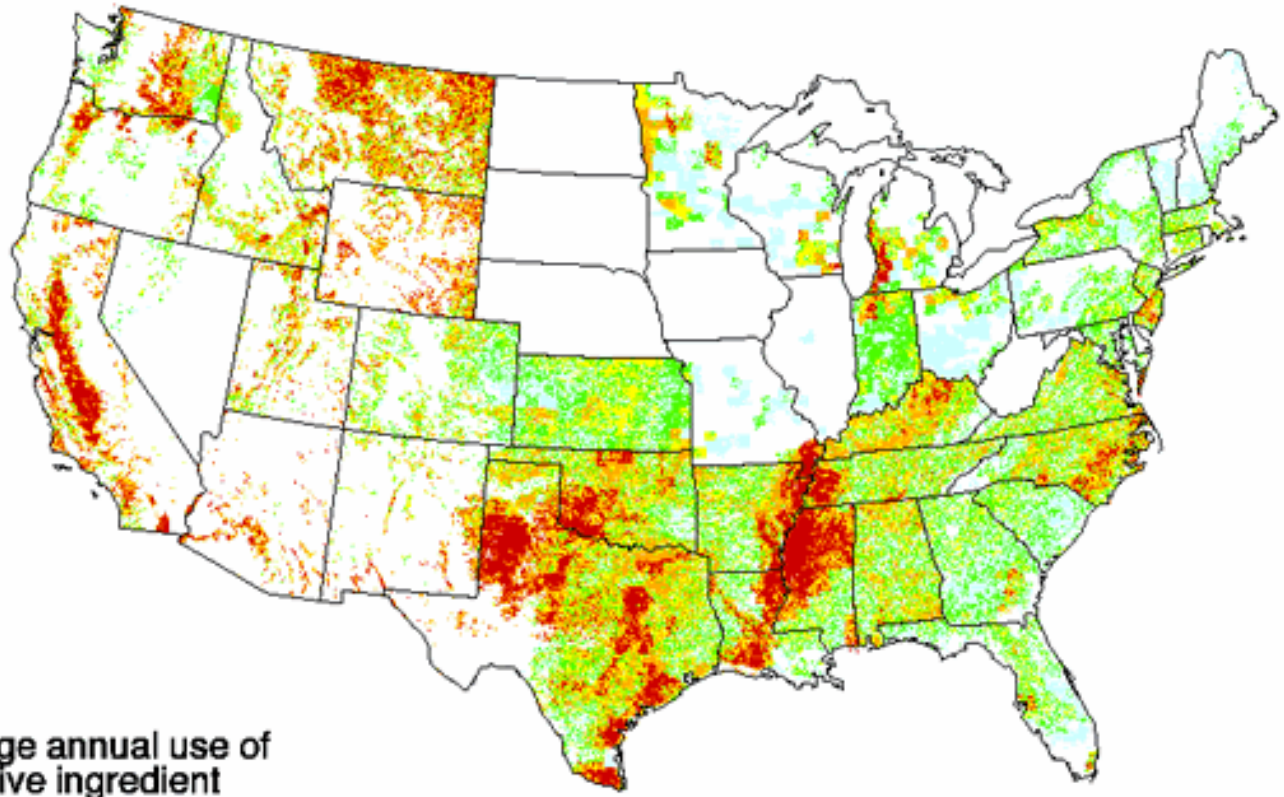
1997 Pesticide Use Maps

Click on a compound name to see a map indicating its use

1,3-D	cyclanilide	ferbam	metolachlor	quizalofop
2,4-D	cycloate	fluazifop	metribuzin	rimsulfuron
2,4-DB	cyfluthrin	flumetralin	metsulfuron	sethoxydim
abamectin	cymoxanil	flumetsulam	molinate	simazine
acephate	cypermethrin	flumiclorac	MSMA	sodium chlorate
acetochlor	cyromazine	fluometuron	myclobutanil	spinosad
acifluorfen	cytokinins	flutolanil	NAA	streptomycin
alachlor	DCNA	fomesafen	NAD	sulfentrazone
aldicarb	DCPA	fonofos	naled	sulfur
ametryn	deltamethrin	formetanate hcl	napropamide	sulfuric acid
amitraz	desmedipham	fosetyl-al	naptalam	sulprofos
asulam	diazinon	gibberellic acid	nicosulfuron	tebuconazole
atrazine	dicamba	glyphosate	norflurazon	tebufenozide
azadirachtin	dichlobenil	halosulfuron	oil	tebupirimphos
azinphos-methyl	diclofop	hexazinone	oryzalin	tebuthiuron
azoxystrobin	dicofol	hexythiazox	oxamyl	tefluthrin
benefin	dicrotophos	imazamethabenz	oxydemeton-methyl	terbacil
benomyl	difenzoquat	imazapic	oxyfluorfen	terbufos
bensulfuron	diflubenzuron	imazaquin	oxytetracycline	thidiazuron
bensulide	dimethenamid	imazethapyr	oxythioquinox	thifensulfuron
bentazon	dimethipin	imidacloprid	paraquat	thiobencarb
benzyladenine	dimethoate	iprodione	PCNB	thiodicarb
bifenthrin	dimethomorph	lactofen	pebulate	thiophanate methyl
bromacil	diquat	lambdacyhalothrin	pendimethalin	thiram
bromoxynil	disulfoton	lindane	permethrin	tralomethrin
buprofezin	diuron	linuron	phenmedipham	triadimefon
butenoic acid	dodine	malathion	phorate	triallate
butylate	DSMA	maleic hydrazide	phosmet	triasulfuron
cacodylic acid	endosulfan	mancozeb	picloram	tribenuron
captan	endothall	maneb	primisulfuron	tribufos
carbaryl	EPTC	MCPA	profenofos	triclopyr
carbofuran	esfenvalerate	MCPB	prometryn	triflumizole
chlorethoxyfos	ethalfluralin	MCPP	pronamide	trifluralin
chlorimuron	ethephon	mefenoxam	propachlor	triflusulfuron
chloropicrin	ethion	mepiquat chloride	propamocarb	triforine
chlorothalonil	ethofumesate	metalaxyl	propanil	triphenyltin hyd
chlorpyrifos	ethoprop	metaldehyde	propargite	vernolate

MALATHION - insecticide

1997 estimated annual agricultural use



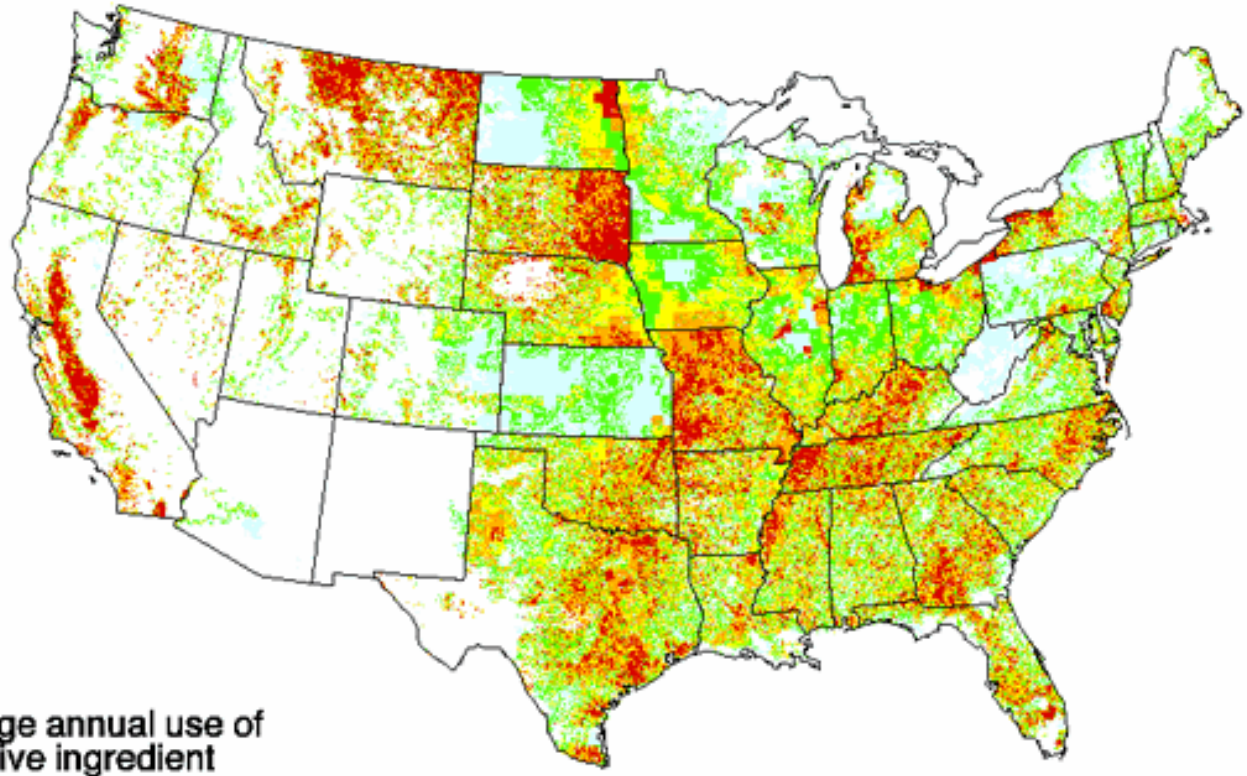
Average annual use of active ingredient
(pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.012
- 0.013 to 0.049
- 0.05 to 0.197
- 0.198 to 0.985
- >= 0.986

Crops	Total pounds applied	Percent national use
cotton	4,192,168	72.70
alfalfa hay	466,072	8.08
wheat	199,897	3.47
other hay	170,238	2.95
rice	134,283	2.33
cherries	79,253	1.37
apples	67,365	1.17
sorghum	51,969	0.90
blueberries	51,388	0.89
pecans	37,191	0.64

CARBARYL - insecticide

1997 estimated annual agricultural use



Average annual use of active ingredient
(pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.05
- 0.051 to 0.177
- 0.178 to 0.483
- 0.484 to 1.378
- >= 1.379

Crops	Total pounds applied	Percent national use
wheat	1, 092, 135	23. 13
other hay	983, 699	20. 83
pecans	389, 337	8. 24
apples	291, 740	6. 18
alfalfa hay	240, 737	5. 10
citrus	234, 686	4. 97
soybeans	151, 088	3. 20
corn	133, 032	2. 82
grapes	131, 106	2. 78
potatoes	86, 448	1. 83

AZADIRACHTIN - insecticide

1997 estimated annual agricultural use

Average annual use of active ingredient
(pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.002
- 0.003 to 0.003
- 0.004 to 0.006
- 0.007 to 0.011
- >= 0.012

Crops	Total pounds applied	Percent national use
lettuce	153	28. 29
bell peppers	119	22. 11
tomatoes	104	19. 24
broccoli	52	9. 66
spinach	37	6. 87
citrus	16	2. 99
celery	15	2. 85
cantaloups	13	2. 55
cauliflower	10	2. 01
green onions	9	1. 67

Mechanical Methods

- hand picking, barriers, traps, vacuuming, tillage can help manage pests

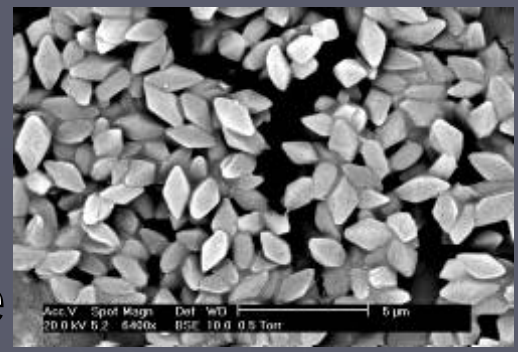
Chemicals (last resort in IPM)

- Synthetic Pesticides: human-made in laboratory
- Organic Pesticides: derived from plants, animal or naturally occurring rock or petroleum oil sources

  biological pesticides: microbial agents

  such as bacteria, viruse, fungi
- Insect Growth Regulators: IGRs disrupt insect's hormonal or developmental processes.
- Do not spray preventively!!!
- Spot treat for the problem areas/pests

Biological Method



- kill, reduce reproduction, or shorten the life
- usually specific to target species or to life stages
- depends on environment or host abundance
- control by pathogens may be unpredictable
- relatively slow acting; they may take several days or longer to provide adequate control

fungus

nematode

fungus

Botanicals (plant derived)

- Neem(neem trees)
  - –Trilogy®
- Pyrethrum (pyrethrum daisy)
  - –Pyganic®, Evergreen®
- Rotenone (subtropical leguminous shrubs)
  - –Pyrellin®
- Spinosad(bacterial fermentation)
  - –Conserve®, Success®, Entrust®

Suffocants & Dessicants

- Suffocants: Soaps, oils, sucrose esters, dusts, DE smothers to prevent breathing OR Disrupts the waxy outer layer (cuticle) of soft-bodied insects, causing the insect or mite to dry out and die
  - –Concern®, Safer®, Surround®, Sucrocide®, Dri-Die®, Bonide®, Entrust®, Success®

Horticultural Oils

Table 1: Some plant pests controlled by horticultural oils.

Dormant Season Applications
- Aphids that curl leaves in spring
- Caterpillars that winter as eggs on the plant (leafrollers, tent caterpillars)
- Mites that winter on the plant
- Scale Insects (e.g., pine needle scale)

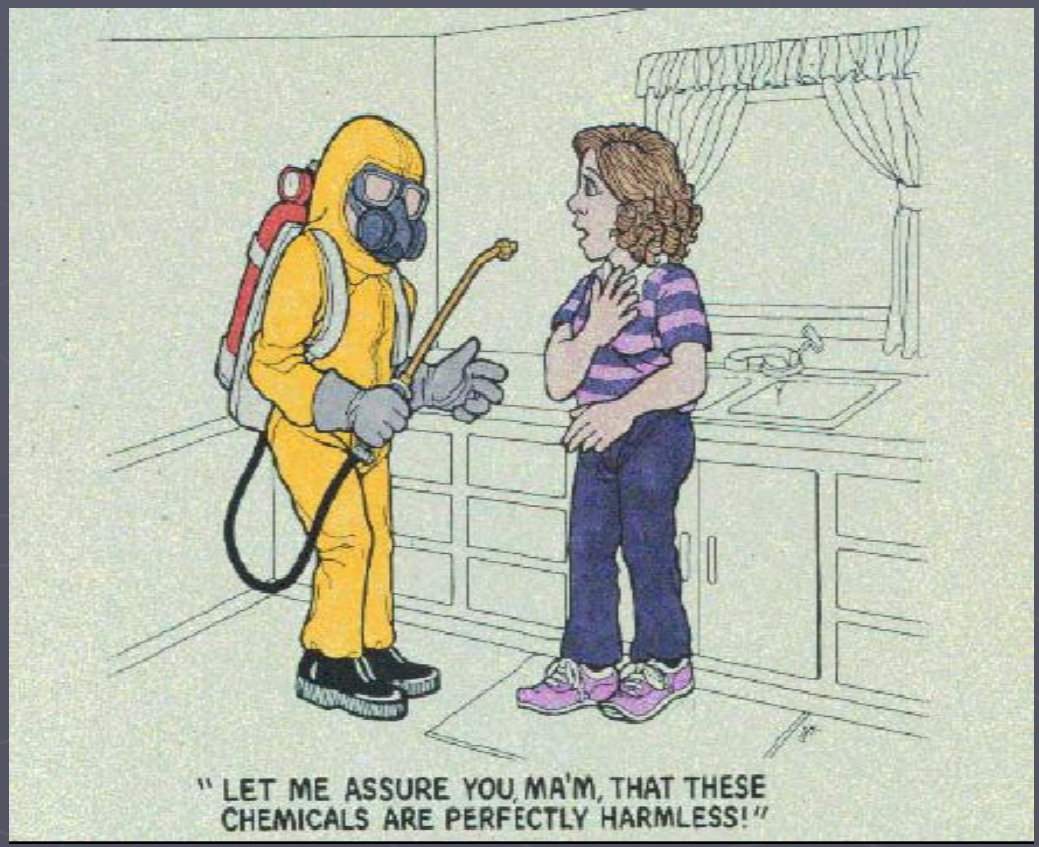
Summer/Foliar Applications
- Insects and Mites
- Adelgids
- Aphids
- Eriophyid mites
- Leafhoppers
- Scale Insects
- Spider mites
- Whiteflies

Diseases
- Powdery mildew
- Some aphid-transmitted viruses

Man – made chemicals

- Chemically joined compounds or elements:

  most herbicides, malathion, carbaryl, imidan, streptomycin



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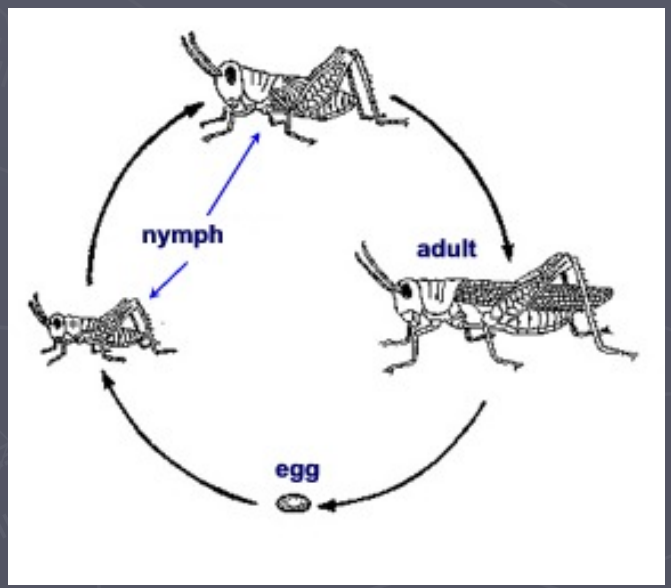
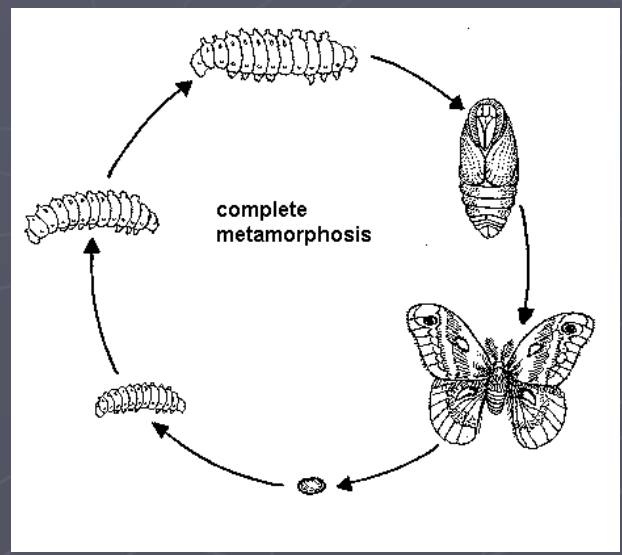
How Do Insects Grow?

- 2 primary modes of growth

Incomplete metamorphosis



Complete metamorphosis



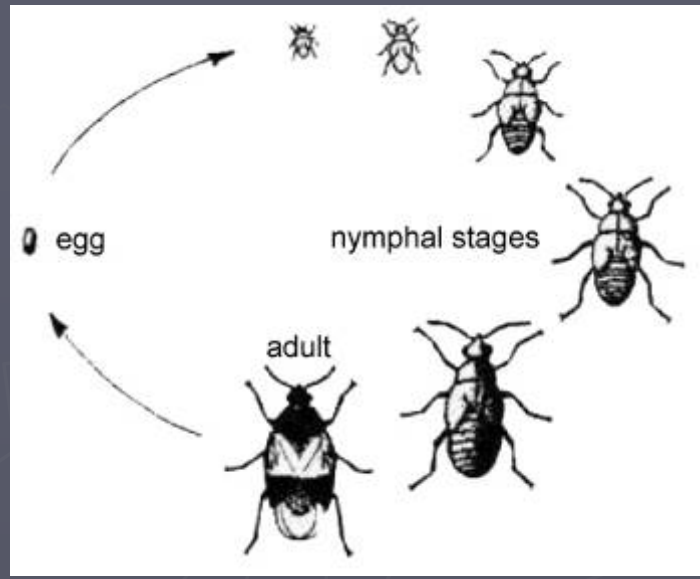
Incomplete Metamorphosis

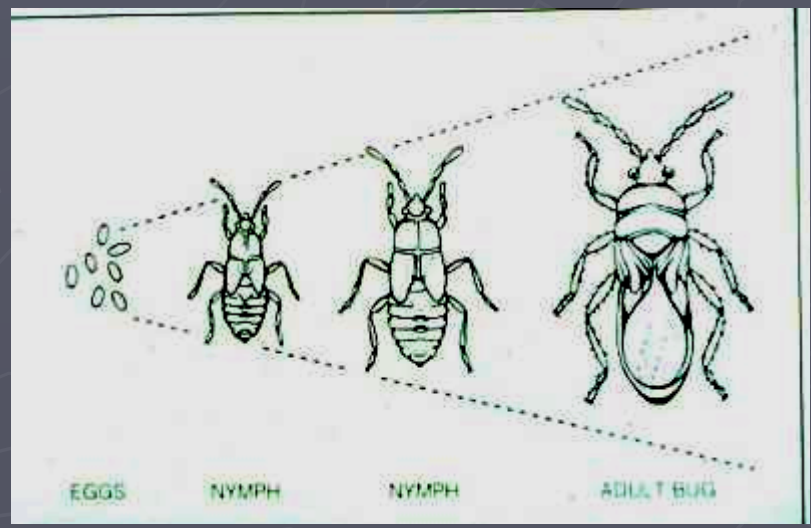
Insect Orders:

Isoptera (Termites)

Hemiptera (True Bugs – stink bugs, squash bugs, thrips)

Homoptera (hoppers, psyllids, aphids, scales)





Complete Metamorphosis

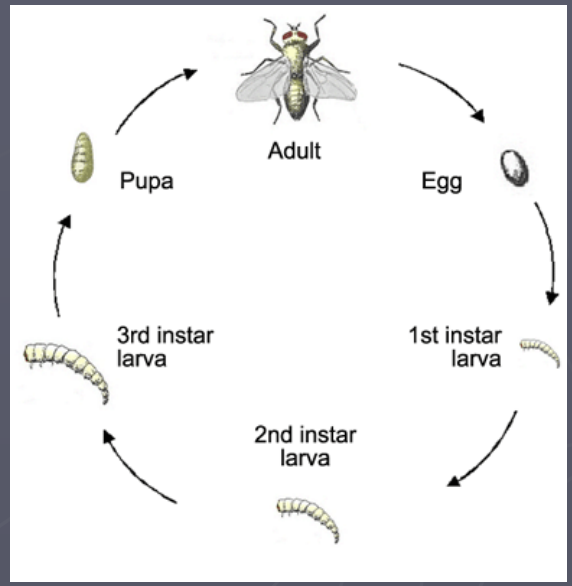
Insect Orders:

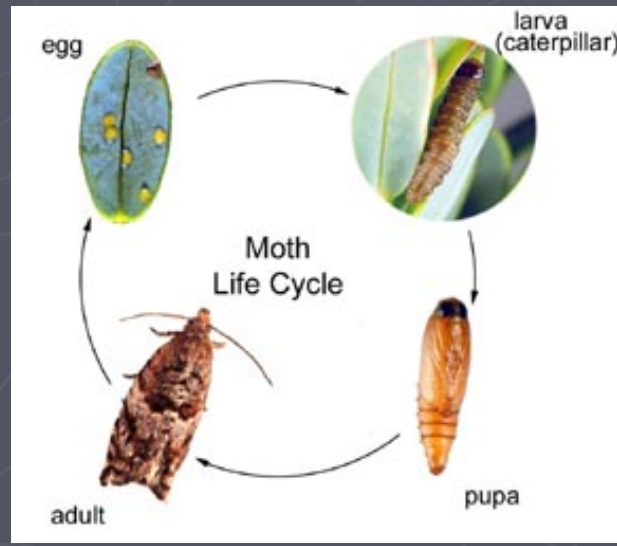
Coleoptera (Beetles)

Lepidoptera (Butterflies & Moths)

Diptera (Mosquitoes, flies)

Hymenoptera (Bees, wasps, ants)





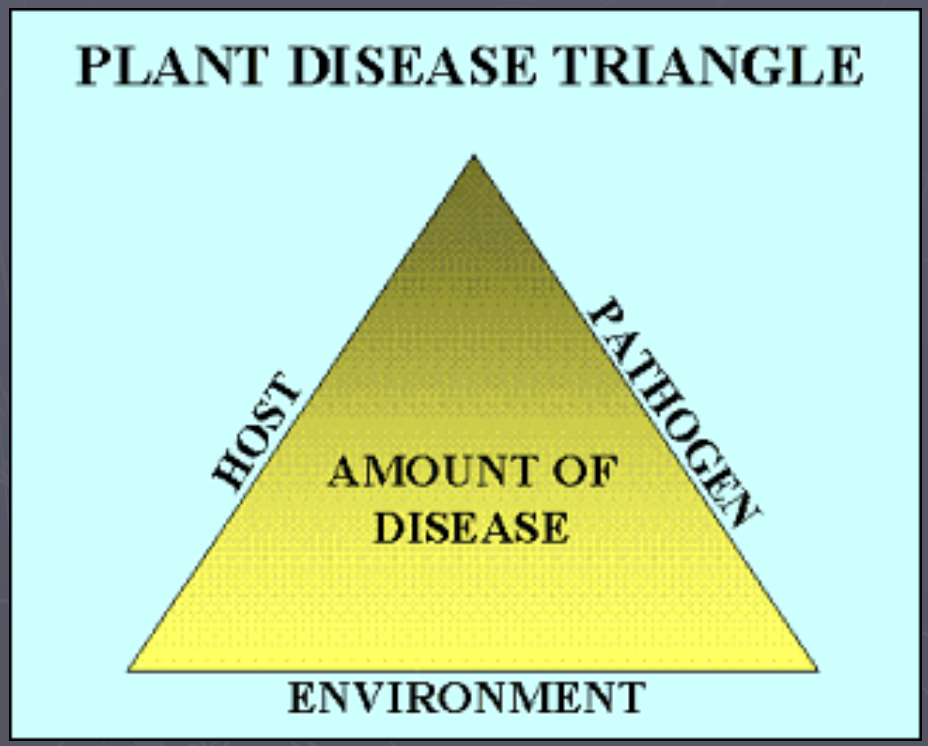
Why is it important?

- Different methods of control depend on the life stage of the insect
- Important to identify insects and understand their life stages in order to control and manage them

Life Cycles of Pathogens

- *Diseases* are defined as abnormal alterations of the internal (physiological) and/or external (morphological) development of the plant. In most cases, infectious *microorganisms*, called *pathogens*, enter the plant causing infection and symptoms to occur. Pathogens are considered the causal agents of disease.

Disease Triangle



1. Causal Agent (Pathogen)
2. Susceptible Host*
3. Favorable Environment *

* You can have an impact on these factors

Cultural Practices

- **Cultural practices:** Various horticultural methods and techniques used to care for plants in the yard and garden. Examples include watering, fertilizing, mowing, weeding, and edging.

- Rotate crops, planting locations
- Seek resistant/tolerant plants
- Avoid susceptible plants (even favorites!)
- Start out with pest-free plants
- Diversify plant selection
- Set up zones for H20, fertilization

Cultural Control recommendations

Landscape Pests

- It is impossible to have a clean garden
- Quick ID and management is key
- Cultural disorders can flare pests
- Cultural control can minimize pests
  - Keep plants healthy
  - Diversify plant selection
  - Target weak links in life cycle

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Earwigs, *Furficula auricularia*

- Feed on a wide variety of plants
- Attracted to decaying animal matter
- 1 generation/year
- Overwinter as adults–Chewing mouthparts–Dark red/brown, small wing pads–Generally crawl–Nocturnal, hide under debris

Earwigs

- Nymphs and adults cause damage
- Look for holes in foliage
- Check garden at night
- Simple traps will work
  - Bran flakes, fish oil, toxicant
  - Rolled newspapers
  - Flat boards
  - Surround®

Japanese Beetle in Utah

- Initially detected in Orem, July 2006
- UDAF set up trapping network
- Not detected outside original “hot spot”
- More than 600 adults have been trapped

Japanese Beetle

- Adults have a broad host range
  - Rose, apple, stonefruits, Virginia creeper, willow, elm, birch, maples, pin oak, sycamore
  - Strongly attracted to ripening fruit
  - Release a mating/feeding pheromone
- Grubs feed on turfgrass roots
  - Overwinteringstage
  - Can weaken turf system

•Adults
–oval, ~1/2”long scarab beetle
–Metallic green with bronze wing covers
–Six white tufts along each side
–Clubbed antennae

http://www.ent.iastate.edu

Japanese Beetle

- Eggs –white, laid in small clusters
- Larvae (grubs)–C-shaped, ~1”long fully developed–Creamy white, brown head, –3 pair of thoracic legs, no prolegs
- Pupae –white, fragile

Adult & eggs

larva

Pupa

Asparagus beetle, cont.

- Adults attracted to young plants
- Damage to ferns and young spears
- Control options
  - Monitor early, harvest frequently
  - Sanitation, remove volunteer plants
  - Neem, Entrust, Surround, Success

Spider mites, *Tetranychus* spp.

- 4 pairs of legs, hairy body
- Overwinter in debris
- Wide host range
- Feed on lower leaf surface
  - Piercing mouthparts
  - Plants look dirty, webbed
  - Can look speckled, yellowed

Spider mites, cont.

- Very successful pests
  - Small size, many generations per year
  - Tolerance of pesticides
  - Like hot and dry weather

- Control options
  - Many natural enemies
  - Keep plants healthy, remove weeds
  - Strong stream of H_20, kaolin clay (Surround®)
  - Kanemite®, Tetrasul®, Floramite®, Hexygon®

Squash bug, *Anasa tritis*

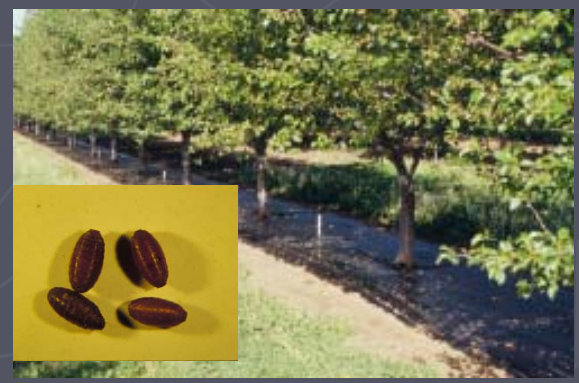
- Feed on cucurbits, squash/pumpkin preferred
- 1-3 generations/year
- Eggs deposited on lower leaves
- Nymphs are gregarious
- Overwinters as adults in debris

Squash bugs, cont.

- Adults are dark brown
  - Piercing-sucking mouthparts
  - Transmit toxic saliva into the plant
  - Wilting, black foliage
- Control options
  - Plant early, early detection, sanitation
  - Difficult to kill large nymphs/adults
  - Apply chemicals to base of plant: Neem®, Bonide®, Surround®

Western Cherry Fruit Fly

- Larvae feed in sweet & tart cherries; female flies lay eggs in ripening fruit; fruit doesn't become soft enough for egg-laying until it turns straw to salmon colored
- Cultural controls: Landscape fabric or barrier under tree canopy
- Chemical control: Imidan (tarts only – 14 d), Malathion (5 d), Sevin (5-7 d), Permethrin (5 d), Success (7 d), GF-120 Fruit Fly Bait



Corn Ear Worm (*Helicoverpa zea*)

- **Signs:** insects bore into heads, feed on leaves, buds, flowers, and pods of beans, eat through kernels of corn, and leave deep watery cavities in fruit
- **Management:** Dense stands of tomatoes discourages leaf hoppers, plant in partial shade, leafhoppers like full sun, remove infected plants immediately

Peach Twig Borer

- Over winter as young larvae on limbs; brown caterpillars burrow inside twigs from bloom to petal fall; a second generation enters fruit, usually at the stem end
- Delayed Dormant Spray: Dormant oil + Pyrethroid or Thiodan (by first pink) – targets twig boring OR At-Bloom Sprays: 2 Bt or Success sprays (early & full to late bloom)
- Fruit protection: Success, Imidan,

Aphids

- Suck fluids from leaves & stems; curl leaves; produce sticky honeydew; black sooty mold growth
- Protect young trees, older trees can tolerate more aphid feeding
- Controls: Heavy Spray of Water, Dormant oil (at green tip stage)
- Insecticidal soap, horticultural oil
- Biological control: lady beetles, lacewings, syrphid flies, parasitic wasps

Snails & Slugs

- **Signs:** irregular holes in leaves, slime trails
- **Management:** Do not overwater. Handpicking daily

  traps – inverted melon rinds

  barriers – copper bands

  natural enemies/predators – ground beetles, birds.

  chemical – iron phosphate bait, safe around pets.

Mexican Bean Beetle

- "Black sheep" of the lady beetle family
- Skeletonize leaves; scar stems & pods
- Cultural controls: Adults over winter in plant debris, clean up garden in fall
- Some beans are more resistant (Asian)
- Plant early and late crops; avoid major activity period of beetle (late July & August)
- Hand pick or squish
- Neem oil, Success

Leafminers in Leafy Veggies

- Adults – Small flies
- Larvae – White to cream maggots
- Winding trails on leaves, white blotches
- Scout regularly, >1 mine/leaf
- Natural enemies (Paper wasp)
- Row covers
- Spinosad (Success, Entrust) insecticide

Cabbage Worms

- Caterpillars chew large holes in leaves; produce abundant frass (excrement)
- Bt (Dipel, Thuricide), Success – very effective
- Row cover fabric) – cover plants to prevent egg-laying

Squash Bug

- Adults & nymphs suck fluids from plant leaves, stems & fruit; may transmit Yellow Vine Disease (bacteria)
- Congregate in plant debris under plants
- Cultural controls: Remove garden debris in fall, nearby woodpiles or other protected sites (adults over winter)
- Hand pick or destroy eggs & nymphs
- Surround (kaolin clay)
- Chemicals: spray when first detect nymphs, drench undersides of leaves & stems (Neem oil,permethrin)

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Curly Top in Tomatoes (Virus)

Adult beet leafhopper, *Circulifer tenellus.*

Photo by L. Dunning.

- **Symptoms:** Plant turns yellow w/purple tinged leaves, plants become stiff then die. Field margins most susceptible
- **Vector:** Beet leafhopper
- **Management:** Dense stands of tomatoes discourages leaf hoppers, plant in partial shade, leafhoppers like full sun, remove infected plants immediately

Downy Mildew

- **Symptoms:** angular patches of discoloration and powdery growth on both sides. Cucurbits
- **Pathogen:** fungus similar to powdery mildew
- **Management:** pick resistant species, Spores spread by rain-splash Avoid using overhead sprinklers. Spacing plants to reduce canopy density and humidity will reduce spread.

Fusarium Wilt in Tomatoes

- **Symptoms:** yellowing leaves, yellow flagging
- **Pathogen:** *Fusarium oxysporum* fungus that invades xylem tissue
- **Management:** use resistant varieties “VFN” means resistance to verticillium, fusarium wilts and nematodes.

  Rotate crops!

Verticillium Wilt in Tomatoes

- **Symptoms:** Leaves have yellow, V-shaped areas
- **Pathogen:** *Verticillium dahliae* fungus survives in soil as microsclerotia
- **Management:** Choose resistant varieties. Rotation to nonsusceptible crops, such as small grains and corn, helps reduce inoculum.

Corn Smut

Fire Blight

- **Symptoms:** shoots appear burnt, shepherd's crook
- **Pathogen:** *Erwinia amylovora,* a bacteria
- **Management:** Prune out diseased wood, well below the affected wood or canker, disinfect tool between cuts.

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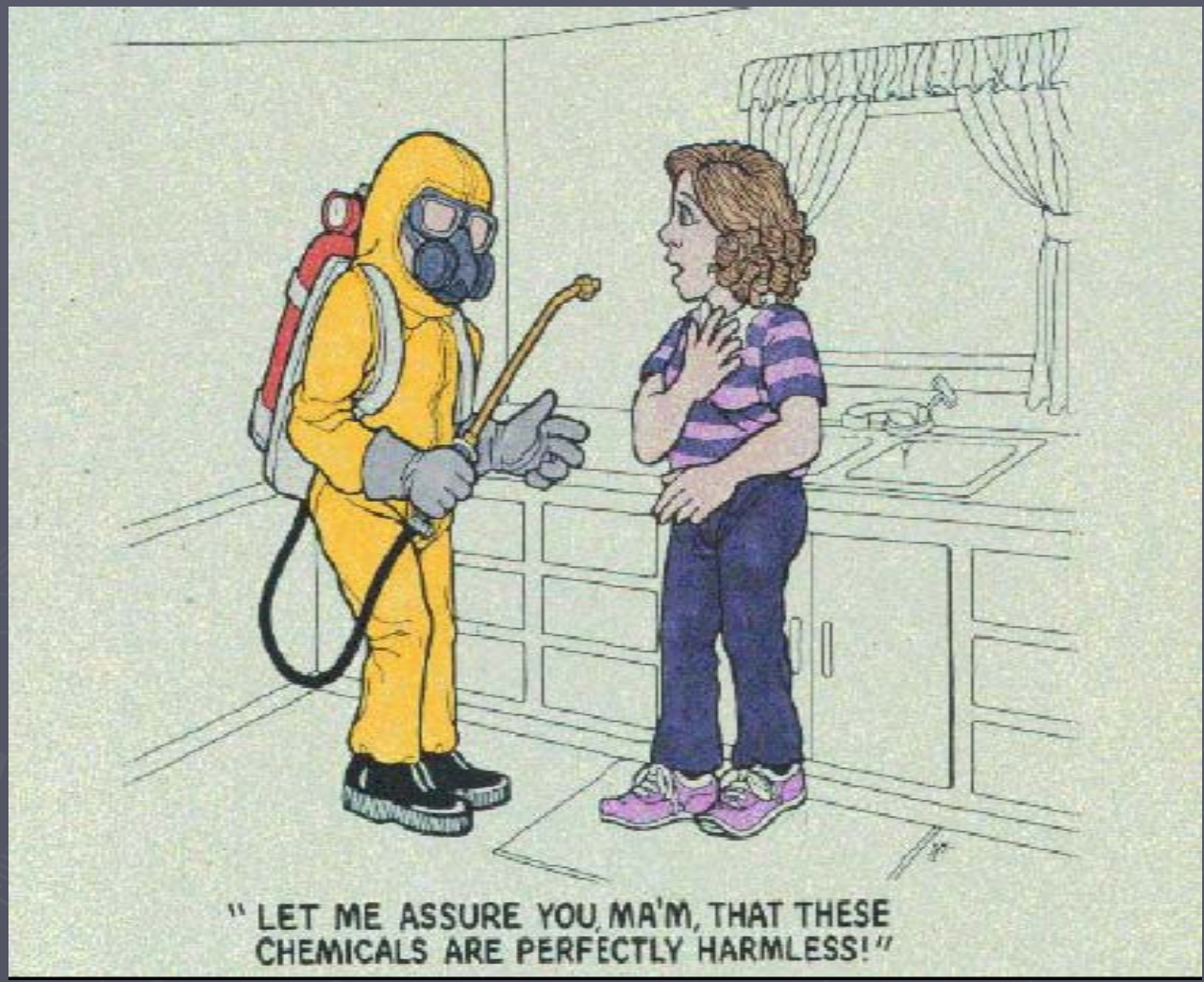
Pesticides


" LET ME ASSURE YOU, MA'M, THAT THESE CHEMICALS ARE PERFECTLY HARMLESS!"

Breast Cancer Linked to Home Pesticide Chlordane

- SOURCE: Breast Cancer Research and Treatment Volume 90:55-64, 2005
- One in eight women in the United States will develop breast cancer according to the latest statistics. Breast cancer rates in the U.S. are 3-7 times higher than those in Asia. This 2005 study conducted at the US Army Institute of Surgical Research and Texas Tech University Health Science Center in Lubbock Texas found that cancerous human breast tissue contained the chemical heptachlor epoxide (found in the common home pesticide chlordane) at levels 4 times higher than non-cancerous breast tissue. Chlordane was the primary termite prevention pesticide used in over 30 million U.S. homes between the mid 1950's and 1988.

Non-Hodgkins Lymphoma Linked to Pesticides & Chemicals

- SOURCE: Annals of Oncology, 5(1):S19-S24, 1994
- The epidemiology of Non-Hodgkin's lymphoma (NHL) was reviewed. In the United States, the annual incidence of NHL rose from 5.9 per 100,000 people in 1950 to 9.3 per 100,000 in 1975, to 13.7 in 1989.
- The most extensive data related to pesticides and the occurrence of NHL suggest that exposure to phenoxy herbicides, particularly 2,4-D (94757), is linked to NHL. Flour millers exposed to fungicides and fumigant pesticides had over a four fold increased risk of NHL.

MSDS Fact Sheet for Diazinon 5WB

VI. HEALTH HAZARD DATA/FIRST AID PROCEDURES

TOXICOLOGY DATA:

Acute Oral LD50 (rat):	1600 mg/kg
Acute Dermal LD50 (rabbit):	>2020 mg/kg
Acute Inhalation (4 hr rat):	>2.5 mg/L
Eye Irritation (rabbit):	Minimal irritant
Dermal Irritation (rabbit):	Non irritant
Dermal Sensitization:	Not a sensitizer

In rats = 0.056 ounce/2.2 lb rat, 50% would die if ingested

In humans = 5.6 ounces/220 lb man, 50% would die if ingested

CARCINOGENICITY, TERATOGENICITY, MUTAGENICITY: Diazinon is not listed as a carcinogen by NRC, IARC or OSHA. The diluent is listed as an IARC (group 3) carcinogen, not classifiable as a human carcinogen (no data available) but with limited animal evidence.
SIGNS OF POISONING: Headache, dizziness, blurred vision, nausea, vomiting, diarrhea, pinpoint pupils
PRIMARY ROUTES OF ENTRY: Ingestion, skin/eye contact
EFFECTS OF SINGLE OVEREXPOSURE:
Swallowing: Headache, dizziness, blurred vision, nausea, vomiting, diarrhea, pinpoint pupils
Skin Absorption: May cause irritation.
Inhalation: May cause irritation of the respiratory tract.
Eyes: May cause mild eye irritation.
EFFECTS OF REPEATED OVEREXPOSURE: Prolonged or repeated overexposure may cause headache, dizziness, blurred vision, nausea, vomiting, diarrhea, pinpoint pupils, skin and/or eye irritation.
OTHER EFFECTS OF OVEREXPOSURE: Ingestion of large amounts may also cause pulmonary edema, muscle twitches and convulsions.
EXISTING MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE: Skin contact may aggravate preexisting skin conditions. Inhalation of mists may aggravate preexisting respiratory conditions.
EMERGENCY AND FIRST AID PROCEDURES:

Swallowing: Call physician or poison control center. If patient is alert and not convulsing give 1 - 2 glasses of water and induce vomiting by tickling the back of the throat or administering syrup of ipecac. Do not induce vomiting or give anything by mouth to an unconscious person.

Skin: Wash affected area with plenty of soap and water. Remove contaminated clothing. Launder contaminated clothing separately. Get medical attention if irritation develops and persists.

Inhalation: Remove victim to fresh air. If not breathing, administer artificial respiration. Avoid unprotected mouth to mouth resuscitation. GET MEDICAL ATTENTION

Eyes: Hold eyelids open and flush with a steady stream of water for at least 15 minutes. GET MEDICAL ATTENTION.

NOTE TO PHYSICIAN: This product may cause cholinesterase inhibition. Emesis is not recommended due to the large amont of petroleum solvent. Check for mucosal damage before beginning gastric lavage, taking care to prevent aspiration. Atropine is antidotal and should be given IV in multiple doses. 2-PAM may be used in severe cases, provided therapy begins within 24 hours of exposure. Monitor serum and RBC cholinesterase.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Botanicals (aka plant derived)

- Neem (neem trees)
  - Trilogy®
- Pyrethrum (pyrethrum daisy)
  - Pyganic®, Evergreen®
- Rotenone (subtropical leguminous shrubs)
  - Pyrellin®
- Spinosad (bacterial fermentation)
  - Conserve®, Success®, Entrust®

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Beneficial Insects

Biological Control

- Insects controlling pests
- Predators, parasitoids, pathogens
  - Most pests have enemies
  - Will respond to low/moderate density

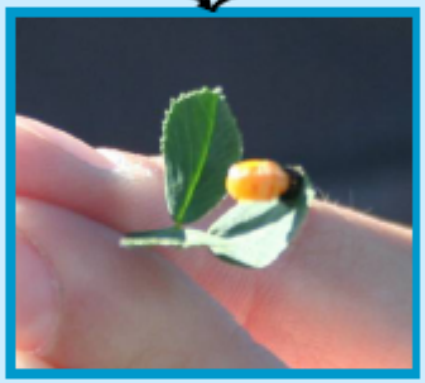
- Encourage natural enemies
  - Use native nectar-producing plants
  - Avoid monocultures

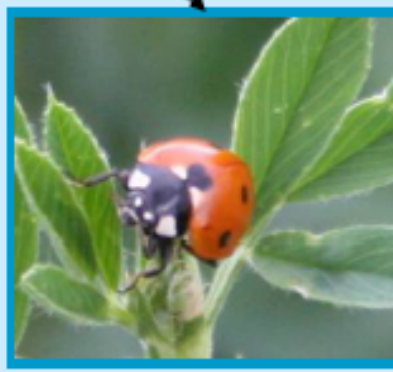
Honeybees

- Did you know that in the United States in the year 2000, 2.5 million colonies of honeybees were rented for pollination purposes that resulted in a increased quality and yield of crops valued at $14.6 billion dollars?

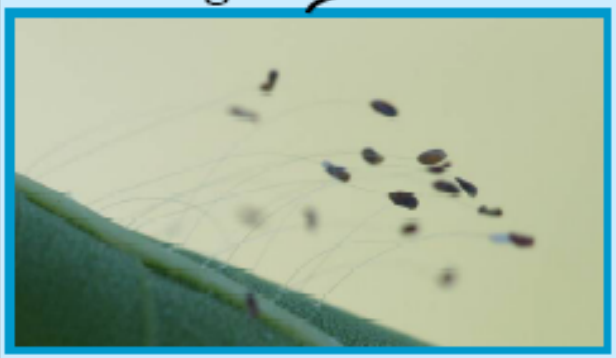
Parasitoid wasp

Ladybug





Lacewing



Beneficial Insects

Syrphid fly

Ichneumonid wasp

Ladybird Beetles

Name that insect

Encourage Beneficials

- Recognize Beneficials, avoid harming eggs and larvae
- Increase diversity of plants that provide habitat for beneficials, nectar plants, pollen plants.
- Reduce use of chemical pesticides, especially broad spectrum insecticides

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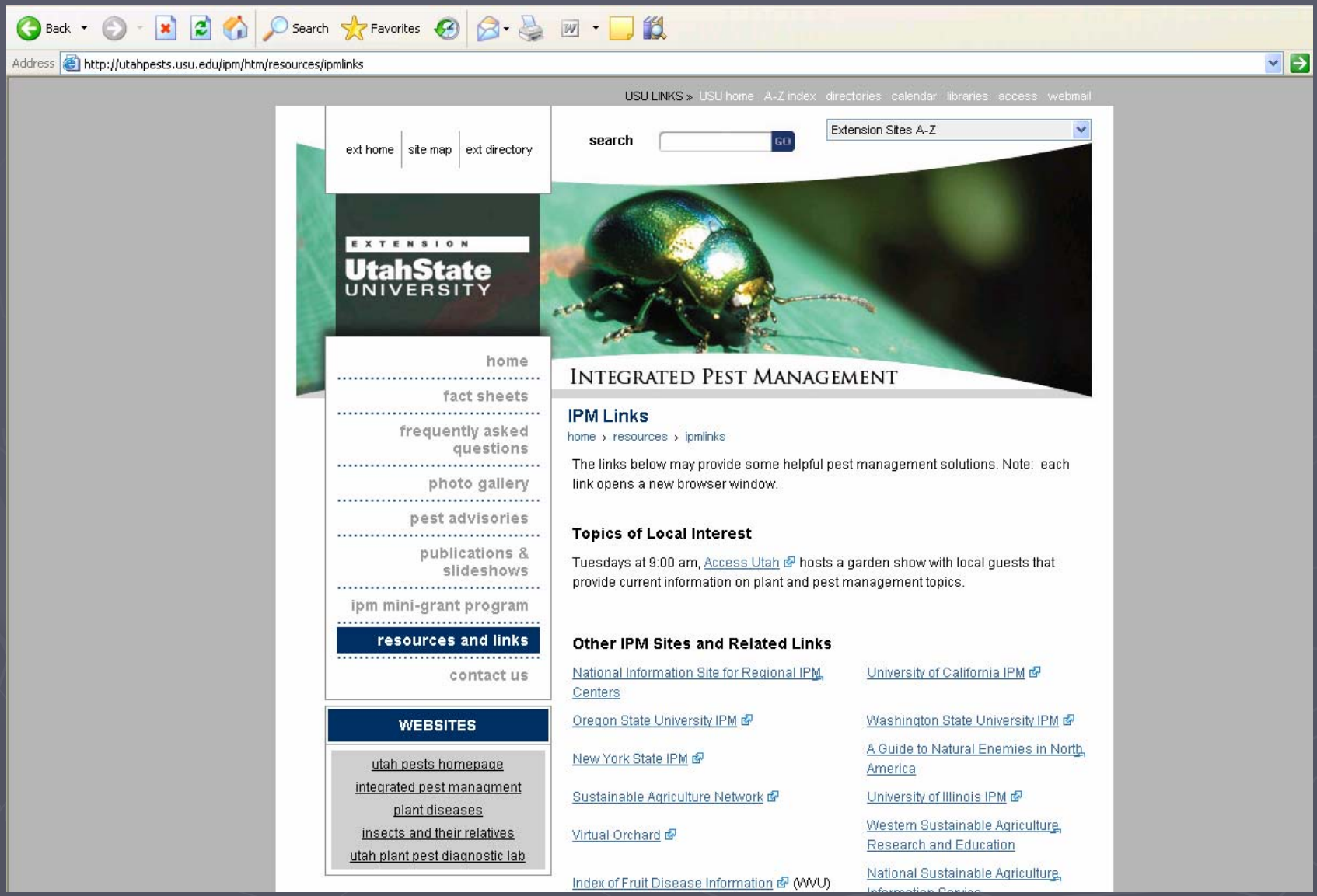
http://utahpests.usu.edu/ipm/



http://ipm.wsu.edu

Address http://ipm.wsu.edu/

WASHINGTON STATE UNIVERSITY *World Class. Face to Face.* CAMPUSES WSU HOME WSU SEARCH myWSU

Cooperative Extension
Integrated Pest Management Program

Now available for PDF download: Washington State's 5-year IPM Report
(must have Adobe Acrobat Reader)

Search

Agriculture IPM

Tree Fruit IPM

- Survey compared IPM practices over the decade from 1989 to 2000
- Significant increase in IPM
- Dramatic reductions in traditional pesticide use
- Overwhelming majority of growers using monitoring, thresholds, mating disruption

Riparian Buffers

- Three research sites near Prosser, WA
- Pest, beneficial arthropods monitored
- Weed pests and alternate pest hosts examined
- Plant diversity and resulting arthropod complex compared among pristine, rehabilitated, and weedy sites

Biocontrol in Fruit, Mint

- Mint growers conserve, augment predatory mites to suppress spider mites of 15,000 acres
- Stone fruit growers

Urban IPM

Turf and Landscape IPM Certification

- Launched November 2000
- Integrated with WSU applicator training and WSDA recertification
- During 2001-2002 season, training reached 3000 individuals

- 743 applicators have applied for recertification; 18 have been certified to date
- 81% of attendees surveyed plan to adopt anintegrated approach

"Hortsense" Home and Garden Outreach

Resource for home gardeners, Master Gardeners, and county agents

- 878 home and gardener fact sheets
- Focus on diagnosis, biology and integrated management of insect, disease, and weed pest problems
- Approximately 35,000 visit the Hortsense website annually

"Pestsense" Urban IPM

http://www.attra.org/pest.html

Pest Management: ATTRA - National Sustainable Agriculture Information Service - Microsoft Internet Explorer provided by Salt La

File Edit View Favorites Tools Help

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Address http://www.attra.org/pest.html

ATTRA

National Sustainable Agriculture Information Service

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800-346-9140 (English)
800-411-3222 (Español)

Publications & Resources

- What Is Sustainable Agriculture?
- Horticultural Crops
- Field Crops
- Soils & Compost
- Water Management
- Pest Management
- Organic Farming
- Livestock
- Marketing, Business & Risk Management
- Farm Energy
- Education
- Other Resources
- Master Publication List

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Home > Pest Management

Pest Management

Pest management sometimes seems especially challenging for farmers dedicated to sustainable, low-input practices. If you're looking to meet the challenge, this series of publications can help. These resources offer a wide array of techniques and controls to effectively reduce or eliminate damage from insects, diseases and weeds without sacrificing the good of the soil, water, or beneficial organisms. Groups of publications available here address:

- Disease Management
- Insect Management
- Weed Management
- Other Pest Management Topics

BIORATIONALS DATABASE

ATTRA has created a new, on-line **pest management tool** for farmers. This database highlights reduced risk materials that can be integrated with ecological pest management strategies.

Disease Management

ATTRA Publications

NOTE: Some of the following documents are available as Adobe Acrobat PDFs. Download Acrobat Reader.

Asian Soybean Rust: Notes and Organic Control Options for Farmers	[Summary] [HTML]
Downy Mildew Control in Cucurbits	[Summary] [HTML] [PDF / 244K]
Organic Alternatives for Late Blight Control in Potatoes	[Summary] [HTML] [PDF / 509K]
Organic Control of White Mold on	[Summary] [HTML] [PDF / 236K]

http://www.ipm.ucdavis.edu/

http://www.ipmofalaska.com

Pesticides Made with Botanical Oils and Extracts

The plant oils described here are complex mixtures of natural substances made by plants. Oils such as lemon, orange, mustard, and anise give fruits and seeds their characteristic odor and taste. Botanical oils are derived from vari part of the plants, such as flowers, fruits, leaves, and wood. The oils are used as pesticides to repel certain animals and insects, and to kill certain insects. Sometimes the chemicals in the oil, as well as the oil itself, are registered a pesticide active ingredients. It is also fairly common for two or more oils to be used in the same commercial product.

Many botanical oils are found in common foods, and many are approved as food flavorings by FDA. However, some botanical pesticides can be quite toxic to humans and should not be used on plants for human consumption. Methyl salicylate (oil of wintergreen) is commonly used as a food flavoring, but it can be quite toxic in large doses.

Pesticides made with botanical oils are derived from plants that are known to have insecticidal properties. It is important to remember that just because a pesticide is derived from a plant does not mean that it is safe for humans ar other mammals or that it cannot kill a wide variety of other life. Many commercially formulated pesticides made with botanical oils contain synthetic chemical synergists. These synergists have no insecticidal effect of their own, b serve to enhance the insecticidal effect of the botanical oils. Carefully read the labels on all products before use to make sure that they do not also contain toxic pesticides.

Pyrethrums, nicotine, and rotenone, are examples of extremely toxic botanical extracts. Pyrethrums are natural insecticides produced by certain species of the chrysanthemum plant. The flowers of the plant are harvested shortly a blooming and are either dried and powdered or the oils within the flowers are extracted with solvents. Pyrethrins (ending in "in") are synthetic pyrethrums and and are very toxic. Even natural pyrethrums are still very toxic and ar included here. Nicotine is produced by the tobbaco plant and is highly toxic in even small doses. Rotenone is an extract obtained from plants in the pea family, such as barbasco, cube, haiari, nekoe, and timbo. Rotenone has long used in "organic" farming. Recent research has linked rotenone to nerve damage and Parkinson's disease. Our point here is that even "natural" plant extracts and pesticides derived from plants are not neccessarily as safe as indic

Many other botanical oils exist that have uses as pesticides such as citrus oils, mint oil, pine oil, capsicum (pepper) extracts, tree oils and and vegetable oils. Some common botanical pesticides made from essential plant oils are li below:

Canola Oil: Canola oil is an edible vegetable oil obtained from the seeds of two species of rape plants, *Brassica napus* and *B. campestris* of the family Cruciferae (mustard family). It is used to control insects on a wide va of crops. Canola oil is considered safe for human consumption. Scientists believe that canola oil repels insects by altering the outer layer of the leaf surface or by acting as an insect irritant. Canola oil appears to have no adverse effects on humans or the environment.

Catnip Oil: Research by Iowa State University and the US Forest Service announced that nepatalactone, the essential oil in catnip, can be used as a very effective mosquito repellent. The authors stated that nepetalacton about 10 times more effective than DEET. The researchers beleive that catnip repels mosquitoes by an irritant reaction.

How to make: in a hand-held spray bottle, mix 1/4-1/2 tsp. of essential oil of catnip (*Nepata cataria*), 1 cup of isopropyl alcohol, and 1 cup of water.

How to use: Shake well and then spray lightly on clothing, arms, and legs, being careful to avoid eyes or open cuts. Do not use on the skin of small children. Some persons may be sensitive to catnip oil. Keep the contents of

Questions?

As a USU Master Gardener,
"Learn well, teach others"

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