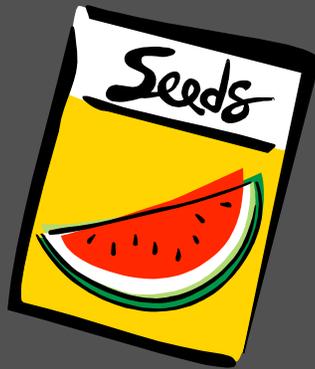


OHIO STATE UNIVERSITY EXTENSION

Pest Management in Home Gardens



Jim Jasinski
IPM Program



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

Objectives

- Discuss basics of pest management
Cultural, biological, & pesticide
- Show approaches to pest management in
specific vegetables
- Basic pesticide safety & toxicology

Integrated Pest Management

Combines the best control tactics to...

- Reduce pesticide use

- Minimize environmental impacts

- Minimize human exposure

- Keep pests at an acceptable level

Does not rely on any one tactic more than others

Avoid impulse to spray first, ask questions later...

Integrated Pest Management

- Not a pesticide free system
 - Pesticides can be used at appropriate times
- Not the same as Organic
 - Restrictions on synthetic pesticides and fertilizers

Integrated Pest Management

■ What is a pest?

■ Some organism, weed, insect, animal, disease, etc., growing or living in a place we don't want it to be.

■ Pest or not?

- Ladybugs
- Dandelions



Integrated Pest Management

5 basic steps

Based on Information

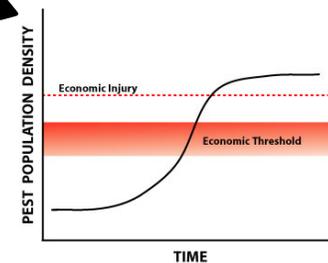
Monitoring



Identification



Thresholds



Action Plan



Evaluation



Action thresholds: Tomato

<i>Pest</i>	<i>Threshold</i>	<i>Insecticide</i> updated	
		<i>Natural</i>	<i>Synthetic</i>
aphids 	>1 colony/leaflet & no natural enemies	Soap, oil, pyrethrins+PBO	acetamiprid (Ortho Bug-B-Gone), imidacloprid (Bayer Fruit, Citrus, Vegetable)
hornworms 	>10% defoliation	B.t. (Dipel)	Spinosad (Bonide Capt. Jack), L-cyhalothrin (Bonide Caterpillar killer)
Fruitworm 	Any larvae in fruit	B.t. (Dipel)	Spinosad (Bonide Capt. Jack), L-cyhalothrin (Bonide Caterpillar killer)
stink bug 	Damage on >10% or fruit  	pyrethrins + PBO	L-cyhalothrin (Bonide Beetle/Caterpillar killer)

Integrated Pest Management Pillars



1. **Cultural control** – Non-chemical tactics used to reduce pest pressure
2. **Biological control** - Using beneficial insects, arthropods, & diseases to reduce certain pests
3. **Chemical control** – The use of pesticides (insecticides, herbicides, and fungicides) to reduce pests

Cultural Controls

- Plant Genetics / Hybrids
- Rotation
- Sanitation
- Mechanical
- Exclusion
- Organic & Inorganic Mulches
- Traps (sticky & pheromone)
- Trap crops

Genetic Resistance

-Disease packages (genes) to withstand specific fungal, viral, bacterial, or nematode attack

Tomato Resistance Codes	
(AB)	Early Blight
(AS)	Alternaria Stem Canker
(F)	Fusarium Wilt
(F2)	Fusarium Wilt (Races 1 & 2)
(F3)	Fusarium Wilt (Races 0, 1 & 2)
(FOR)	Fusarium Crown and Root Rot
(L)	Gray Leaf Spot
(LB)	Late Blight
(LM)	Leaf Mold
(N)	Nematodes
(PL)	Corky Root Rot
(PM)	Powdery Mildew
(PST)	Bacterial Speck
(TMV)	Tobacco Mosaic Virus
(ToANV)	Tomato Apex Necrosis Virus
(ToMV)	Tomato Mosaic Virus
(TYLCV)	Tomato Yellow Leaf Curl Virus
(V)	Verticillium Wilt

HR: = High Resistance IR: = Intermediate Resistance

Spinach Resistance Codes	
(DM)	Downy Mildew
(Cv)	Cladosporium Leaf Spot

HR: = High Resistance IR: = Intermediate Resistance

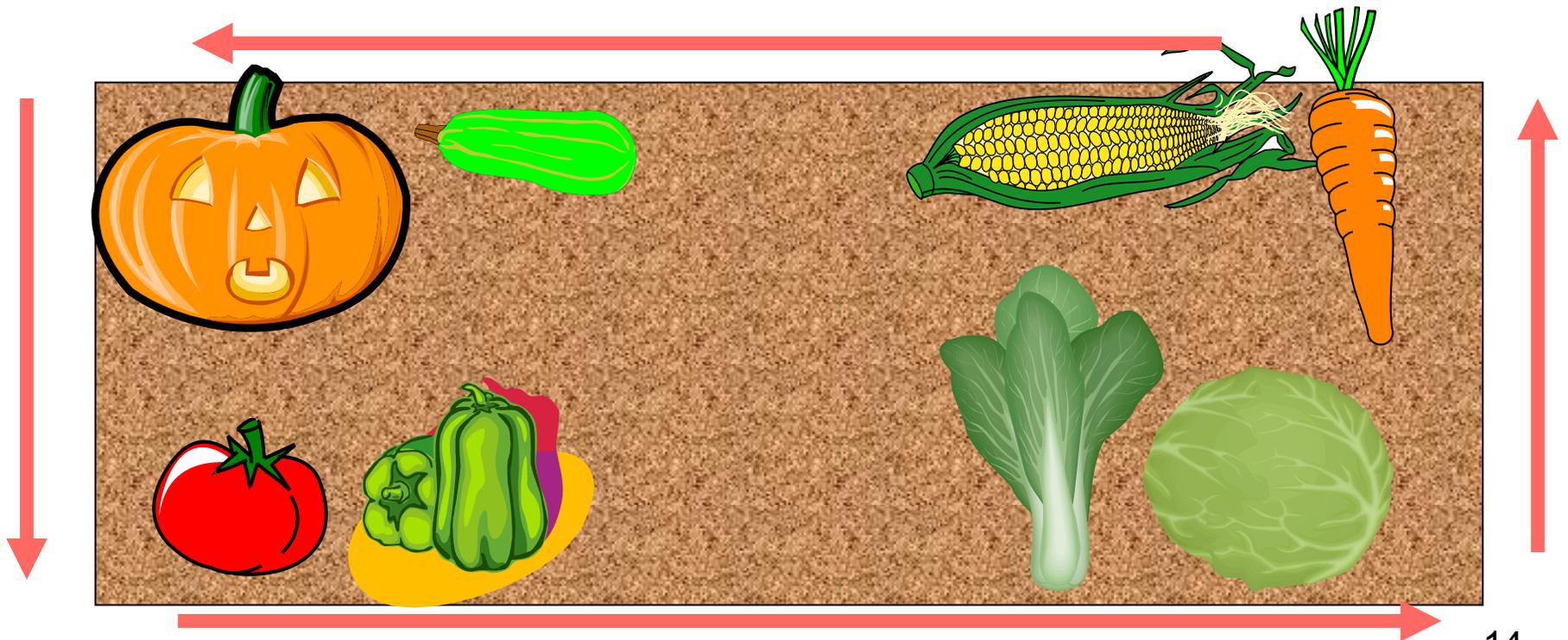
Summer Squash Resistance Codes	
(CMV)	Cucumber Mosaic Virus
(PM)	Powdery Mildew
(PRV)	Papaya Ringspot Virus
(WMV)	Watermelon Mosaic Virus
(ZYMV)	Zucchini Yellow Mosaic Virus

HR: = High Resistance IR: = Intermediate Resistance

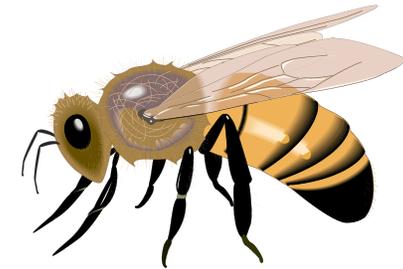
64-6697 Johnnyseeds.com

Rotation

- Move crops around, be aware of families
 - Cole, Solanaceous, Cucurbits, Legumes, etc.
- Break up Disease & Insect life cycles



Exclusion



- Plastic Collars, Coffee Tins
- Prevents insects from reaching plants



www.gardening.cornell.edu



Exclusion - Row Covers

Remove IF crop needs pollination!!



Row Covers

- Exclude insect pests
- Increase plant growth (heat)
- Protect from frost
- Weed control can be a major issue
 - Choose fields w/ reduced weed pressure
 - Black plastic
 - Card board, Newspaper
 - Weed screen/fabric



Row Covers

Row Cover and
Weed Control



No Row Cover or
Weed Control



No Row Cover, but
Weed Control



Row Cover/Weed Control

Date	Row Cover + Newspaper		Non-weeded, No row cover		Newspaper, No row cover	
	Zukes	Cukes	Zukes	Cukes	Zukes	Cukes
7/21	7	0	2	0	4	0
7/26	6	7	1	0	5	3
7/31	8	8	0	0	6	6
8/2	1	1	2	0	1	1
8/4	1	2	0	0	1	3
8/7	2	2	0	0	1	2
8/9	5	1	1	0	4	2
8/11	0	0	0	0	1	0
Total	30	21	6	0	23	17

Row covers increase yield, weed competition reduces yield

Raised Beds

- Good for areas where native soil is...
 rocky, contaminated, boggy/wet, uneven
- You control soil mix going into bed
- You control size of bed 4x4, 3x8, or ?x?
- Warms up early in spring, promotes germination, growth, early crops, drains quickly
- May cost \$\$\$, extra watering, rotation issues















Weed Seed Bank

"One years seed = seven years of weed"

- 1 weed can produce 10,000's of seeds that remain viable in the soil profile for years
- Seeds brought to the surface by tilling, digging, hoeing, etc., can germinate and become weed seedlings
- Germination factors include water, light, temperature, & oxygen
- Compete with vegetable plants for water, nutrients, sunlight, and space (produce fewer fruit)
- Weeds can be hosts for insects and diseases
- Must control weeds before they set seed!!!**

Weed Seed Bank

Table 1. Seed production capability of several agronomic weed species.¹

Weed species	Number of seeds produced per plant²	Longevity of seeds in soil (years)³
Barnyardgrass	700,000	5
Common purslane	1,800,000	20-25
Velvetleaf	48,000	15-40 +
Puncturvine	100,000	15-20
Shepardspurse	150,000	15-35
Eastern black nightshade	825,000	40 +

1. Adapted from the California Weed Science Society's Principles of Weed control Third Edition. 2002. Thomson Publications, Fresno CA.

2. Seed production in the absence of significant competition.

3. Seed survival in most species declines rapidly within the first few years, with only a small percentage of seed surviving for extended periods.

Using Mulches

Want to ***reduce*** hoeing and hand pulling?

Mulch around plants to help **retain soil moisture** and **reduce weed growth**

-Organic mulches - decompose naturally in the soil

-Inorganic mulches – plastic films that do not decompose readily

-Bio-degradable films that last only 1 season, broken down by light and moisture

Using Organic Mulches

Types of **Organic** mulches

bark chips, compost, ground corncobs, chopped cornstalks, grass clippings*, leaves, manure*, newspapers*, peanut shells, peat moss, pine needles, sawdust, straw, wood shavings, cardboard*

Conserve soil moisture, **reduce** soil temperature by 8° to 10° F during the summer

Do not apply too early in the spring

Cool soils slow germination and plant development



Springfield garden in August

Using Plastic Mulches

Black plastic warms soil temperatures 5-6 °F

- Most common type
- Reduces light and weed seed germination
- Recommended for peppers, melons, cucumbers, squash, tomatoes. etc.

Black Plastic Mulch-early



Black Plastic Mulch - later



Newspaper mulch



Weed block fabric



- Heavy-weight woven ground cover, from A.M. Leonard, \$96.49 per roll (6 ft x 300 ft)
- Held down by anchor pins (garden staples), \$0.05 each



Weed block fabric



Mulch Suppliers

Biodegradable plastic mulches

<http://growerssolution.com/page/GS/PROD/ecoblack>

Plastic mulches and weed cloth

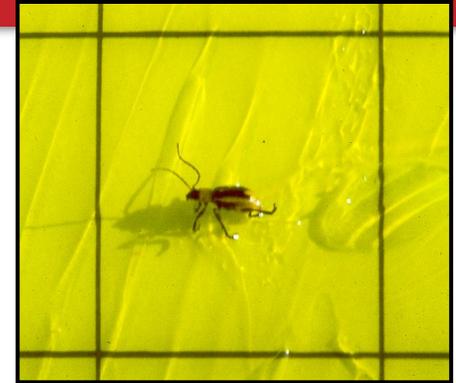
<http://www.gardeners.com/>

Local garden centers, Big Box Stores

More plastic mulches

<http://www.robertmarvel.com/>

Traps



In general...

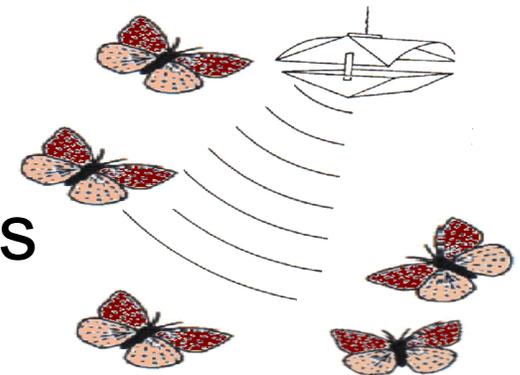
- Work 24/7
- Good early warning system for some insects

Sticky Traps

- Used for monitoring
- Traps beneficial and pest insects

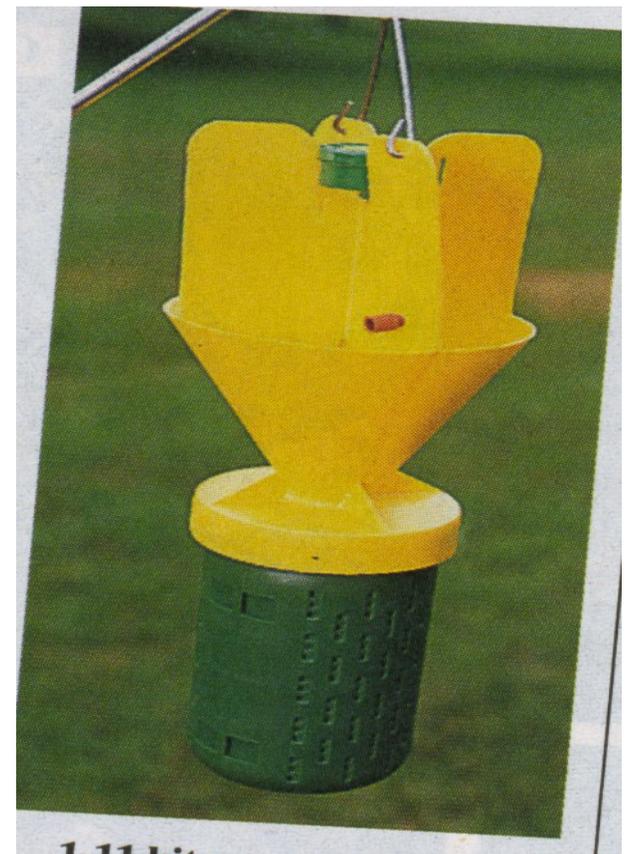
Pheromone Traps

- Used for monitoring specific insects
- Trigger more intense scouting



Traps & Trapping

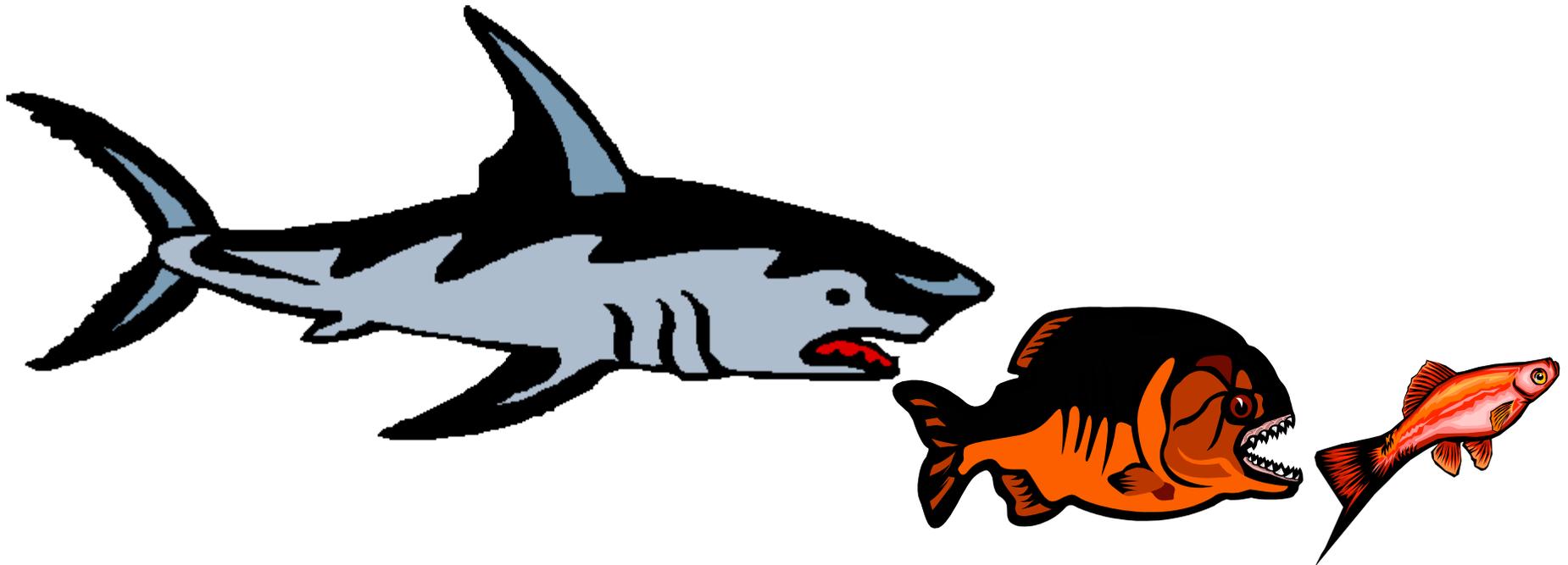
- Combo Traps – Japanese beetle
 - Use Pheromones & Scent
 - Use visual stimuli
 - Catch both males and females
 - Potentially draws more insects to a crop than it traps
- Capture rate is about 50%
- Successful???



Gemplers 2000 catalog
43

Biological Control

- Using a pest's natural enemies to control it
- Usually works well with insects



Biological Control

- Using a pest's natural enemies to control it



Biological Control

Conservation

- Recognize beneficial insects & arthropods
- Use targeted insecticides when possible

Encouragement

- Plant flowers as a nectar & pollen source

Augmentation

- Lacewings, Praying Mantids, Parasitic Wasps, etc.
- Immediate effectiveness???

Refuge planting for natural enemies



**sweet
alyssum**



cilantro

nasturtium



Phacelia



dill



Natural Enemies

Ladybugs

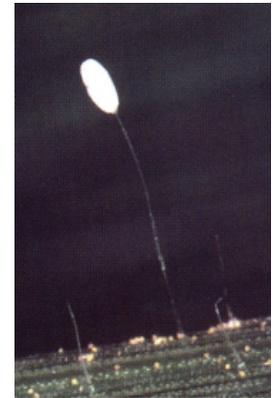


Iowa
State
University

More Ladybugs



Green lacewings



Praying mantids



Ground beetles



Iowa State University



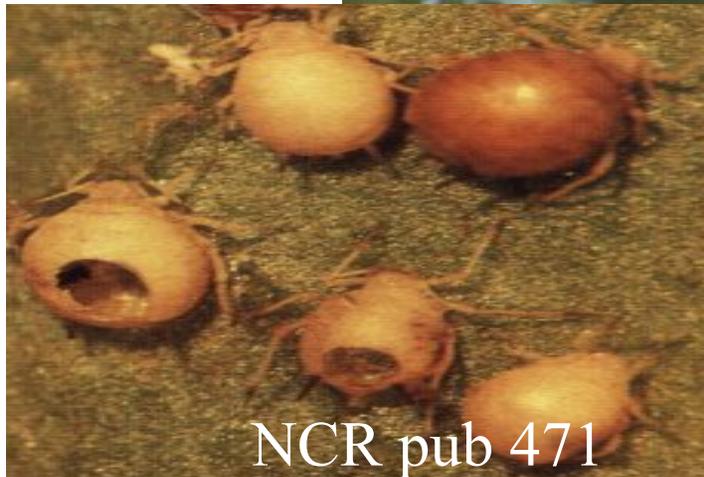
Rick Weinzeirl



Midwest Vegetable Insect Manual

Parasitoid Wasps

Attack aphids



NCR pub 471

Parasitoid Flies

Attack eggs & caterpillars



NCR pub 471

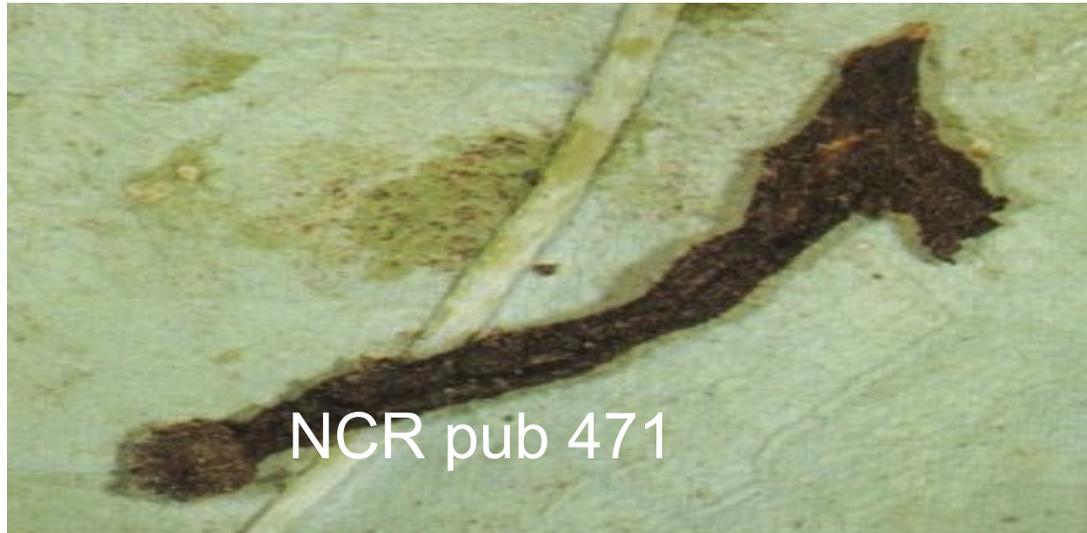


Spiders



Audobon's Insects & Spiders

Fungi, Bacteria, Viruses



Nematodes



Insecticides for Garden Food Crops

- Carbamates (Sevin)
- Organophosphates (Malathion)
- **Pyrethroids** (Permethrin, Bifenthrin)
- Neonicotinoids (Imidicloprid, Acetamiprid)
- **Microbials** (Bt, Spinosad)
- Botanical (Neem, Azadirachtin, Pyrethrum)
- Soaps & Oils
- Elemental (S, Cu)

Pyrethroids, ums, and ins

- Pyrethrum – raw, unrefined insect killing active ingredient extracted from chrysanthemum flower heads
- Pyrethrin – refined Pyrethrum
- PBO – Piperonyl butoxide, synergist
- Pyrethroid – synthetic pyrethrums or pyrethrins, longer lasting, higher activity

Pyrethroids: now 5 for food crops *new*



permethrin

Esfenvalerate*

bifenthrin

cyfluthrin

lambda-cyhalothrin

Insecticides of natural origin

- Microbials (from micro-organisms)
 - *B.t.* (bacteria)
 - Spinosad (bacteria)
 - *Beauveria* (fungus)

What is Bt?

- *Bacillus thuringiensis* (Bt)
- Common Soil Bacterium
- Harmless to Vertebrates
- Harmful to Certain Insect Groups
 - Moths, Beetles, Mosquitoes & Flies
- Insects Killed by ICP
 - (Insecticidal Crystal Protein)

Bt's Mode of Action

- Bt insecticide sprayed on plant
- Insect Ingests Bt
- ICP Released into Insect's Midgut
- ICP Causes "Ulcers" in Midgut
- Insect Stops Feeding
- Internal Bleeding Results in Death

Which set of ears were sprayed w/ insecticide?



Neither, sweet corn on left is transgenic (Bt)