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Backyard Vegetable Integrated Pest Management

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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IPM Program

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Objectives

- Basics of Pest Management
  - -Process
  - -Cultural
  - -Biological
  - -Chemical (pesticides)
- Basic Pesticide Safety & Use
- IPM in Action Examples

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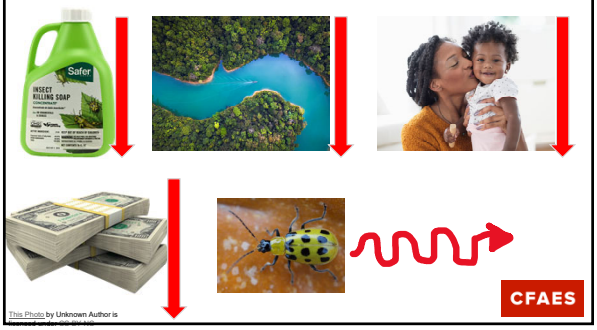
Integrated Pest Management

Combine Multiple Tactics to…



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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

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Integrated Pest Management

5 basic steps

Based on Information

- **Monitoring**
- **Identification**
- **Thresholds**
- **Action Plan**
- **Evaluation**

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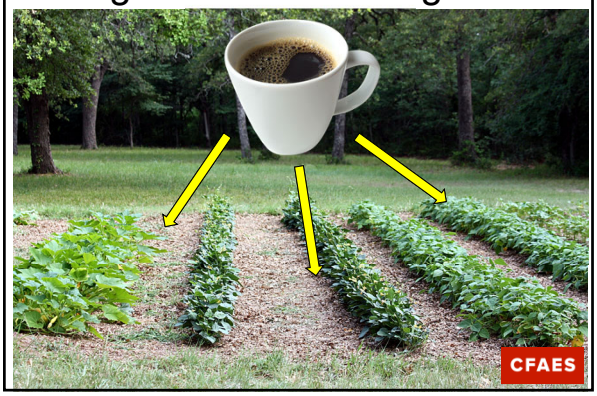
Integrated Pest Management



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Integrated Pest Management

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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

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Managing Tomato Pests

Pest	*Threshold*	*Cultural*	*Biological*	*Chemical*
aphids 	>1 colony / leaflet & no nat. enemies			
hornworms 	>10% defoliation			
Fruitworm 	Any larvae in fruit			
stink bug 	Damage on >10% of fruit			

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Cultural Controls

- Hand Removal (I, W, D)
- Syringing / Blasting (I)
- **Traps (sticky & pheromone) (I)**
- **Exclusion / Row Covers (I,W*,D*)**
- **Organic & Inorganic Mulches (W,D)**
- **Host Plant Resistance (D)**
- Rotation (I,W,D)
- Sanitation (I,W,D)
- Trap Crops (I)
- Planting Time (I,W)

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Traps (I)

In general…
-Work 24/7
-Early warning trap for some insects

Sticky Traps
-Used for monitoring
-Traps beneficial and pest insects

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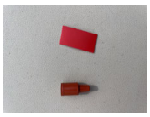
Traps (I)



In general…
-Work 24/7
-Early warning trap for some insects

Pheromone Traps
-Used for monitoring specific insects
-Trigger more intense scouting

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Exclusion - Row Covers (I,D*)

-Exclude insect pests
-Remove for pollination
-Increase plant growth (heat)
-Protect from frost (S/F)
-Weed control can be an issue
  -Choose area w/ reduced weed pressure
  -May need to mulch
-Lower disease pressure(?)

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Raised Beds (W)

-Add I,D* benefits if paired with row covers
-Soil warms up earlier, promotes germination, growth, early crops
-Good for rocky, contaminated, boggy/wet, uneven ground
-You control “soil / soil less” mix in RB
-Ergonomics
-Cost $-$$$; material & size of bed ?’x?’
-Drain quickly, extra watering, rotation issues

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Elevated Raised Bed

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Elevated Raised Bed Series

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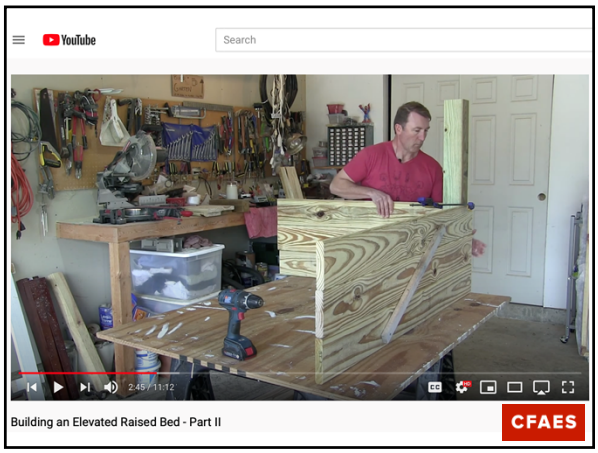

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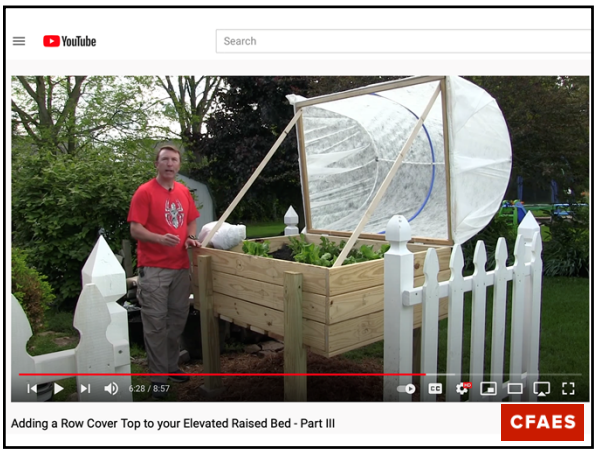

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Weed Seed Bank

Don't Let Them Go To Seed!

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

Weed species	Number of seeds produced per plant[2]	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 +

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Mulches (W, D)

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

Larry Bass, 2000, Extension Horticultural Specialist, Home Vegetable Gardening, North Carolina

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Straw mulch - Springfield garden in August

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Newspaper mulch

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Plastic Mulches

Black plastic warms soil 5-6 ºF

-Most common type

-Reduces light and weed seed germination

-Recommended for peppers, melons, cucumbers, squash, tomatoes. etc.

-Needs drip irrigation

Larry Bass, 2000, Extension Horticultural Specialist, Home Vegetable Gardening, North

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Weed block fabric

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Seed Catalogs

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Host Plant Resistance (D)

-Tolerance / Resistance to specific pathogens

Johnny's Seed Catalog

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Host Plant Resistance (D)

-Tolerance / Resistance to specific pathogens

RED DETERMINATE (Bush) TOMATO VARIETIES COMPARISON CHART

Part #	Variety	Days	Fruit Size	Firmness	Disease Resistance
2591	BHN 1021	76	8–16 oz.	Firm	HR: F (1, 2), N, TSWV, V.
3226	BHN 589	75	8–10 oz.	Firm	HR: F (1, 2), TMV, V.
733	Celebrity	72	7–8 oz.	Firm	HR: AS, F (1), N, TOMV, V.
2525G OG	Defiant PhR	65	6–8 oz.	Medium	HR: F (1, 2), LB, V. IR: EB.
4055G OG	Galahad	69	7–12 oz.	Medium	HR: F (1–3), GLS, LB, N, TSWV, V.
4151	Grand Marshall	78	10–14 oz.	Firm	HR: AS, F (1, 2), V. IR: GLS, TYLCV.
3808	Mountain Fresh Plus	75	8–16 oz.	Firm	HR: F (1, 2), N, V.
3204G OG	Skyway	78	8–12 oz.	Firm	HR: F (1–3), ToANV, V. IR: N, TSWV, TYLCV.

Tomato Resistance Codes

HR = High Resistance IR = Intermediate Resistance

(AS)	*Alternaria* Stem Canker
(CRR)	Corky Root Rot
(EB)	Early Blight
(F)	*Fusarium* Wilt
(FOR)	*Fusarium* Crown and Root Rot
(GLS)	Gray Leaf Spot
(LB)	Late Blight
(LM)	Leaf Mold
(N)	Nematodes
(PM)	Powdery Mildew
(TMV)	Tobacco Mosaic Virus
(ToANV)	Tomato Apex Necrosis Virus
(ToMV)	Tomato Mosaic Virus
(TSWV)	Tomato Spotted Wilt Virus
(TYLCV)	Tomato Yellow Leaf Curl Virus
(V)	*Verticillium* Wilt

Johnny's Seed Catalog

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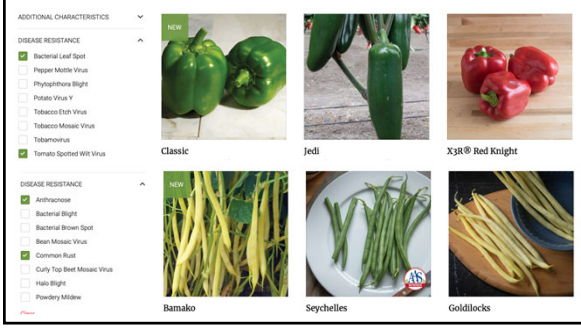
Host Plant Resistance (D)

-Tolerance / Resistance to specific pathogens



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Host Plant Resistance (D)

-Tolerance / Resistance to specific pathogens

https://savvygardening.com/

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Biological Control

■Using a pest's "**natural enemies**" to control it

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Biological Control

■Using a pest's "**natural enemies**" to control it

Predator

Parasitoid

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Biological Control

- **Recognize** (identify) beneficial insects & arthropods
- **Preserve** natural enemies by using targeted insecticides when possible
- **Attract** natural enemies by planting flowers as a nectar & pollen sources

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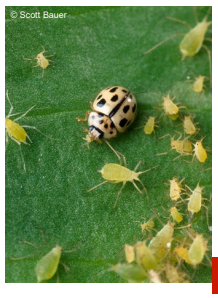
Biological Control in Action!

Use of natural enemies to keep pest populations low, reduce use and reliance on insecticides

Predators



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Biological Control in Action!

Use of natural enemies to keep pest populations low, reduce use and reliance on insecticides

Parasitoids

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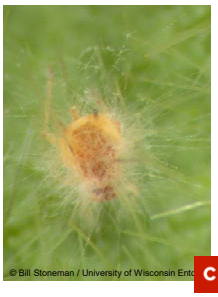
Biological Control in Action!

Use of natural enemies to keep pest populations low, reduce use and reliance on insecticides

Pathogens



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Recognize These Arthropods?

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Flowering plants attract natural enemies

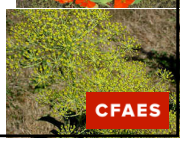
Phacelia

sweet alyssum

nasturtium

cilantro

dill



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Chemical Control (Pesticides)

Safety and Use

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Pesticide Safety

- Identify the problem (I, D, W)
- Exhaust Cultural and Biological options
- Buy right product / Target (read label)
- Use right amount
- Pay attention to **Signal Words**
  - Caution
  - Warning
  - Danger

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Pesticide Safety

- Read Label - Prevent harm to yourself, others, the environment
- Pay attention to label warnings
  - Weather, surface water restrictions
- Pay attention to **PPE**
  - Gloves, goggles, hats, shoes, etc.
- Store products away from children
- Always keep product in original container

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Chemical Control (Pesticides)

Products designed to "kill" pests

Insecticides
Contact vs Systemic

Fungicides
Protectant vs Systemic

Herbicides
Selective vs. Non-Selective

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Insecticides for Garden Crops

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

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General Insecticide Choices

Insecticide Group	*Insects controlled**
Spinosad	Caterpillars, flies, beetle larva & adults, nymphs
Soaps and oils	Aphids, mites, whitefly
Neonics (acetamiprid, imidicloprid)	Aphids, whitefly, stink bugs, squash bugs, btls
Pyrethroids (cyfluthrin, permethrin, L-cyhalothrin, etc) Pyrethrins + PBO	Most insects
Carbamates & OP (Sevin & malathion)	Most insects
Bt	Caterpillars, beetle larva

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Pyreth**rums**, **thrins**, & **throids**

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

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Pyrethroids: now 5 for food crops

new

permethrin
Esfenvalerate*
bifenthrin
cyfluthrin
lambda-cyhalothrin

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Microbials (Bt)

- *Bacillus thuringiensis* (Bt)
- Common Soil Bacterium
- Bt discovered in 1911
- Target Specific Insect Groups
  - Moths, Beetles, Mosquitoes & Flies
- Harmless to Vertebrates
- Insects Killed by **Ingesting** ICP
  - (Insecticidal Crystal Protein)

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Pest Profiles

Using what we've learned so far…

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General Pests: Slugs

Monitor – jagged leaf feeding, fruit feeding, slime trails

ID - Soft bodied, slimy creature

Dept. of Entomology, OSU, IPM image library

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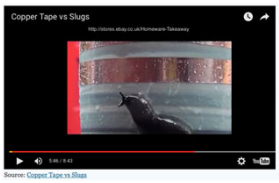
General Pests: Slugs

Cultural

•BEER filled pie plates …sometimes



•Copper Strips – A shocking experience…sometimes

http://www.gardenmyths.com/

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General Pests: Slugs

Cultural

•Dry out area – add sand?

•Diatomaceous Earth- reapply after rain

•Alternative remedies: cedar chips, egg shells, coffee grounds, **sweet gum balls** and pine needles??

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General Pest: Slugs

Biological

•Ground beetles, song thrushes, toads, frogs, insects…

Chemical

•Slug baits (Metaldehyde), Iron phosphate (Sluggo)

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General Pests: Aphids

Monitor

On stems, branches, & underside of leaves

Feed on all types of plants

Can cause growing tip to curl

ID

•Small soft bodied insects w/ sucking mouth parts

•Suck plant juices, excrete honeydew, may cause black sooty mold

•Vector viruses

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General Pests: Aphids

Cultural Controls

- Choose virus resistant varieties if possible
- Consider syringing or wiping off with glove
- Row covers
- Early Planting

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General Pests: Aphids

Bio-controls
Lady Beetles
Parasitoid Wasps

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General Pests: Aphids

Bio-controls: Lacewings

Iowa State University / Minnesota Dept. of Agriculture

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General Pests: Aphids

Chemicals

Soap and oil products
Acetamiprid - systemic
Conserves beneficial insects

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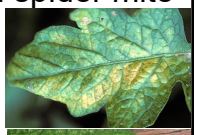
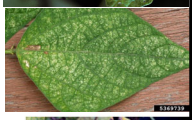
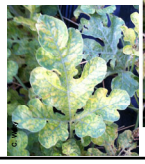
General Pest: Two-spotted spider mite

Monitor
-Tomato
Yellow blotches
-Bean
White stippling
-Watermelon
Yellow blotches
Brown lesions
-Thrives in hot, dry weather







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General Pest: Two-spotted spider mite

Monitor

- Often overlooked
- Often mistaken for disease
- Tolerable at low density

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ID: Two-Spotted Spider Mite

- Tiny (1/60 inch),yellow with 2 dark spots, 8 legs*
- Fine webbing on leaf underside
- Tap leaf over paper, look for moving specks
- Early diagnosis for good control

webbing

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TSSM Management

Cultural

Rain, overhead irrigation can help

Biological

Conserve natural predators

Chemical

Insecticidal soap

Horticultural Oil

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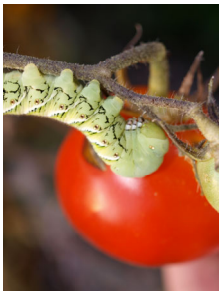
Pest Management for Tomato



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Pest: Hornworms

Monitor

- Chewed foliage, fruit, and frass
- Look for missing canopy and fresh frass

ID

Large green worm

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Hornworms

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Cultural: Pick mature caterpillars off of plant

Biological: Don't kill if parasitoid pupal cases are found on caterpillar (*Cotesia* sp.)
-bird & hornet predators

Chemical: Spinosad, Pyrethroids, Bt (if small)

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Pest: Caterpillars

yellow striped armyworm, tomato fruit worm, variegated cutworm

Monitor

- Larvae in fruit, sides and bottom
- Pheromone traps TFM, VCW

Identify

- Which worm is it? Doesn't really matter, all treated the same

Cultural Control

- Pick worms out / cull fruit

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Pest: Caterpillars

yellow striped armyworm, tomato fruit worm, variegated cutworm

Bio-control

- Ground beetles, parasitoids, birds

Chemical

- Pyrethrin + PBO, Pyrethroids, Bt

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Pest: Stink Bugs

Monitor

- Foliage, Green and Red fruit
- Look for yellow/white cloudy spot

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Pest: Stink Bugs

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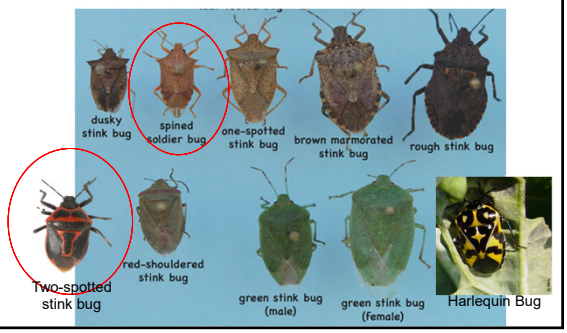
Identification – Most bugs are pests. Two are beneficial.



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Brown marmorated stink bug

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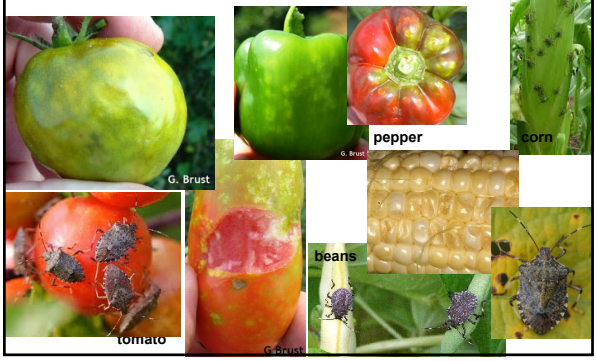

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Pest: Stink Bugs

Cultural Control

-Pick bugs off

-Cull significantly damaged fruit

Biological Control

-stink bugs, parasitoid wasp, spiders

Chemical Control

-Pyrethroids, Acetamiprid, Spinosid for nymphs

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Sticky Traps w/ Pheromone

2 lures on a clear sticky panel, near wooded edge
Monitoring only, not managing

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Managing Tomato Pests

Pest	*Threshold*	*Cultural*	*Biological*	*Chemical*
aphids 	>1 colony / leaflet & no nat. enemies			
hornworms 	>10% defoliation			
Fruitworm 	Any larvae in fruit			
stink bug 	Damage on >10% of fruit			

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Questions?

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Please Let Me Know How I Did This Afternoon

(I promise to make it better next time!)

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